The
Tool Engineer

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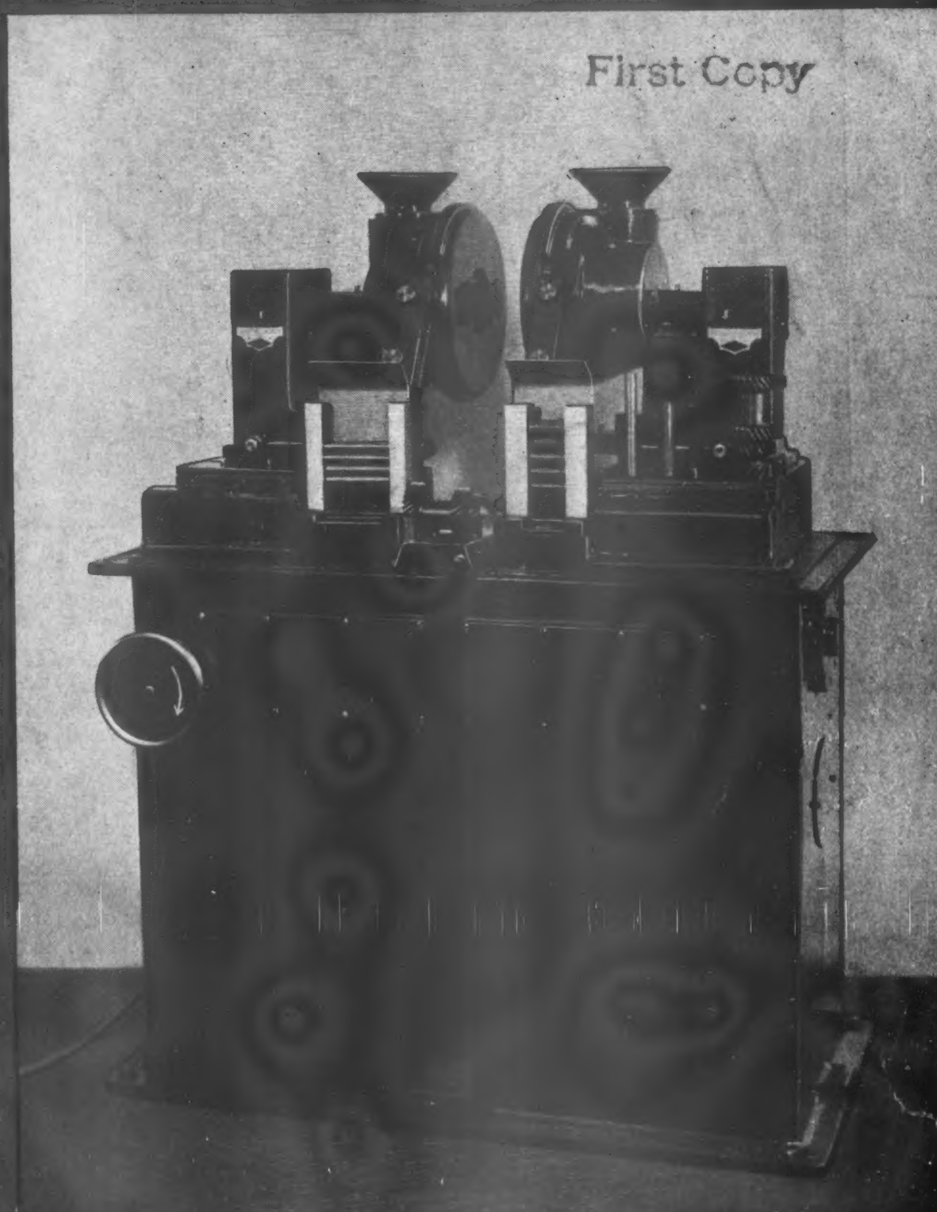
MARCH, 1937

In This Issue



Needle Bearing Assembly—See page 43

ASTE

Official Publication of the
AMERICAN SOCIETY OF TOOL ENGINEERS

Classification of Work
Automotive
Piece Name - Rear Axle Driving Gear
Material - H.R. Steel

First Chucking Operations:

1st Sta. - Unload and Load.

2nd Sta. - Drill, Rough Turn and Rough Face.

3rd Sta. - Drill, Semi-Finish Turn and Rough Face.

4th Sta. - Rough Face, Rough Chamfer and Rough Groove.

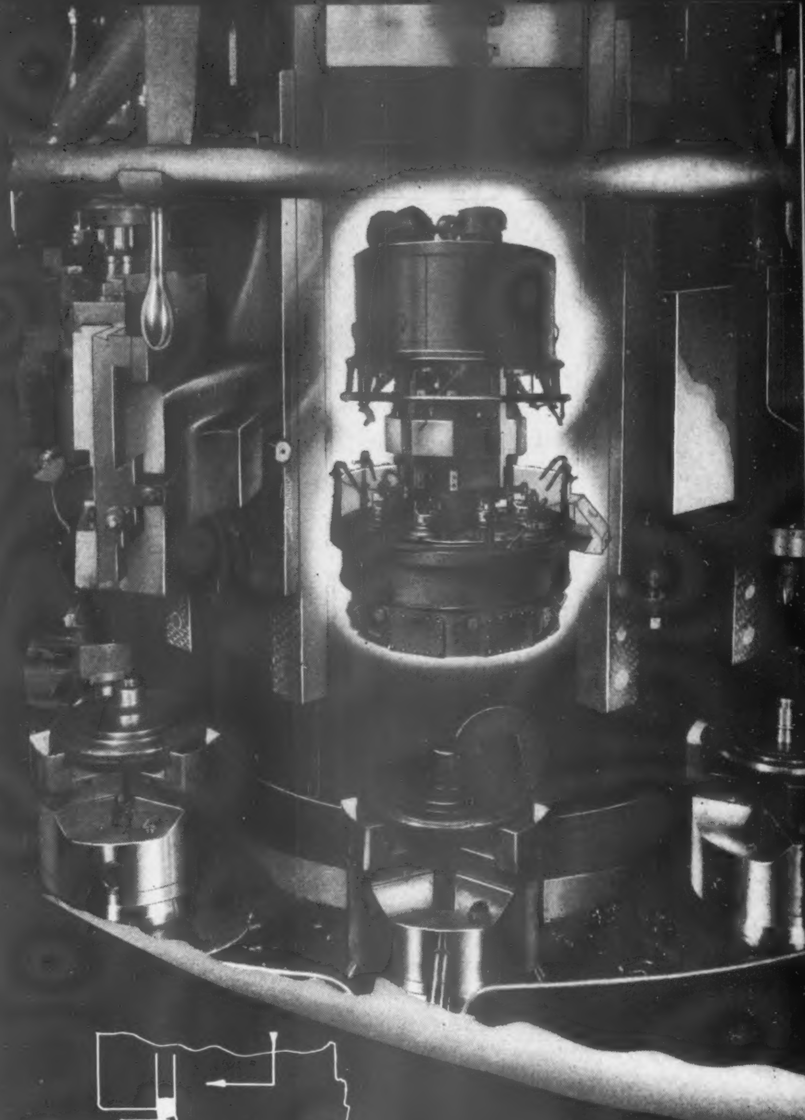
5th Sta. - Chamfer and Finish Groove.

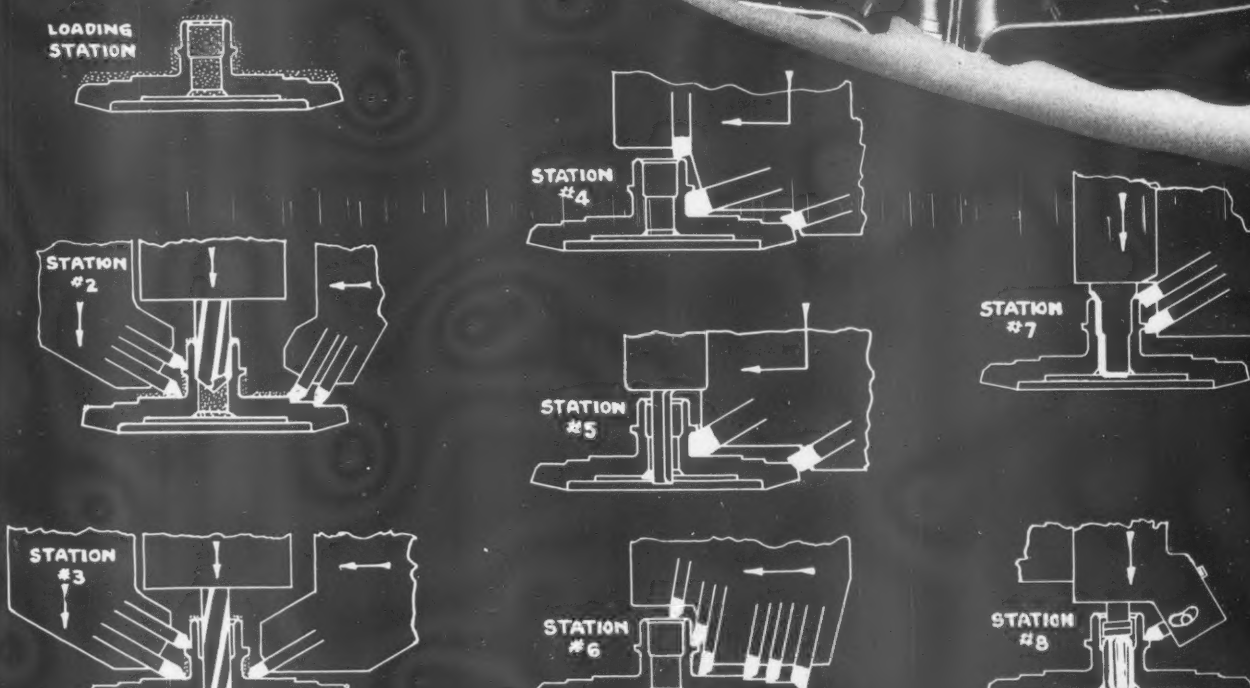
6th Sta. - Finish Face and Chamfer.

7th Sta. - True Bore, Finish Turn, and Chamfer.

8th Sta. - Finish Turn and Ream.

Time per Piece - 1 Minute 39 Seconds.





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Official Publication of the AMERICAN SOCIETY OF TOOL ENGINEERS

Vol. V MARCH, 1937 No. 11

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Application blanks and information pertaining to membership in the American Society of Tool Engineers may be had by addressing **The Tool Engineer,** 2842 W. Grand Boulevard, Detroit, Michigan, or the Secretary's office, 5928 Second Blvd., Detroit, Michigan. **Dues** are $5 initiation fee, $6 per year for senior grade membership and $3 per year for junior grade membership. Junior membership initiation fee $2.

The Tool Engineer is published on the first Thursday of each month. It is the official publication of the American Society of Tool Engineers, Incorporated. The membership of the Society and readers of this publication are practical manufacturing executives such as master mechanics, works managers, Tool Engineers, tool designers and others who are responsible for production in mass manufacturing plants throughout the nation and in some foreign countries.

Owing to the nature of the American Society of Tool Engineers organization, it cannot, nor can the publishers be responsible for statements appearing in this publication either as papers presented at its meetings or the discussion of such papers printed herein.

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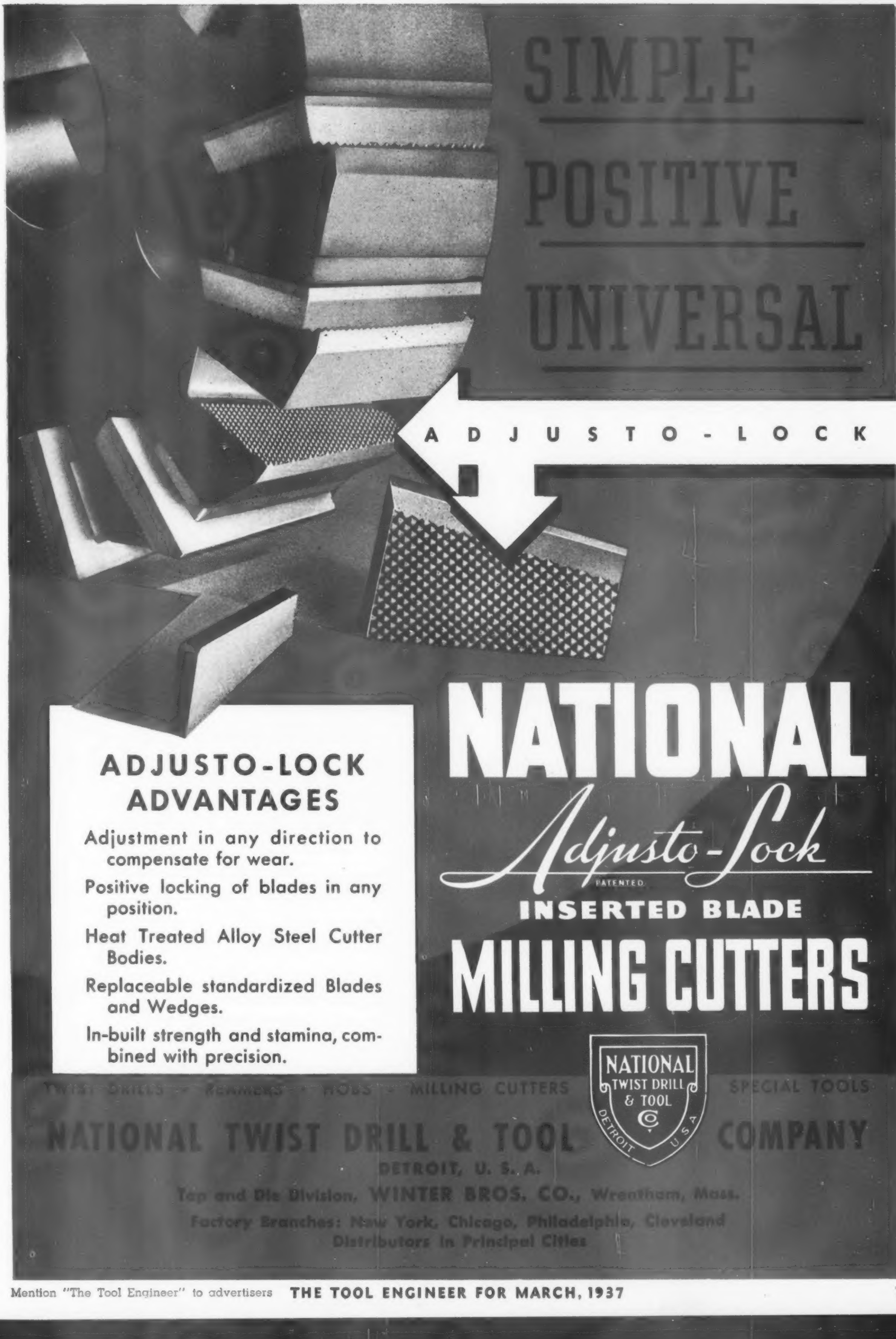
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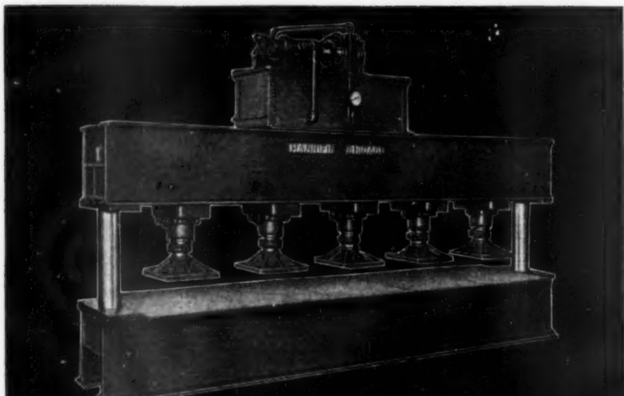

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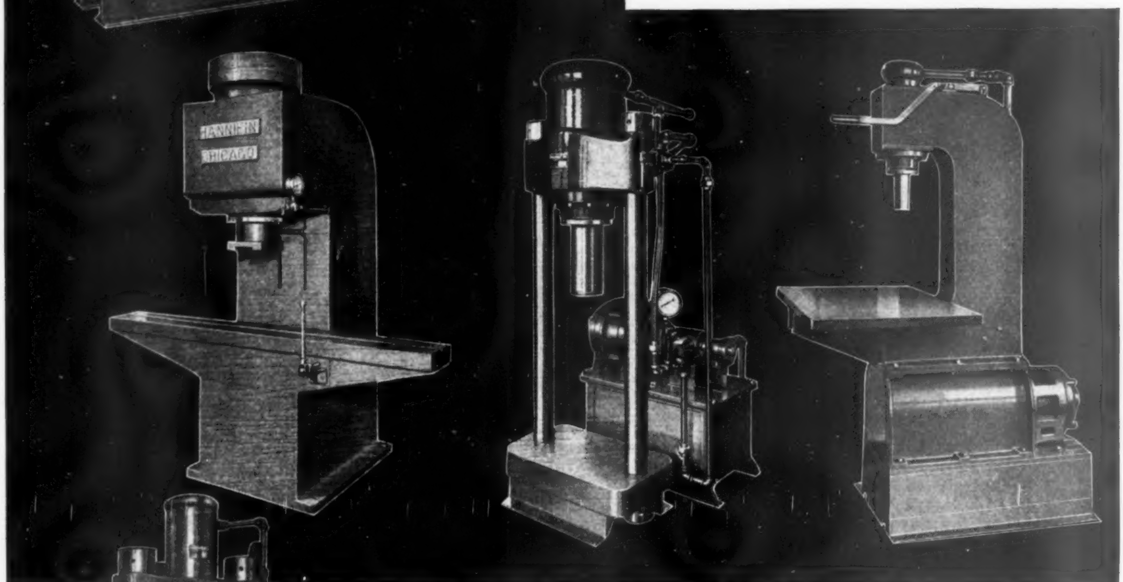

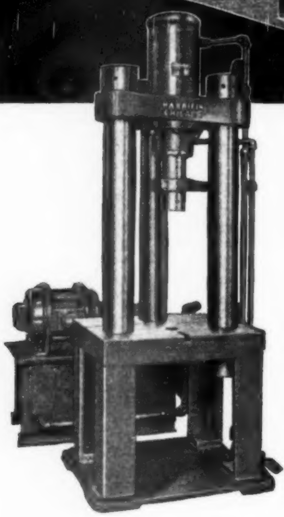

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Write for new Bulletin 40 on Hydraulic Presses

ENGINEERS • DESIGNERS • MANUFACTURERS • PNEUMATIC AND HYDRAULIC PRODUCTION TOOL EQUIPMENT

HANNIFIN SPECIAL HYDRAULIC PRESSES

TECHNICAL ASPECTS
OF
TOOL ENGINEERING

O. B. JONES
FOUNDER, A.S.T.E.
TECHNICAL EDITOR
for this issue

EVERY vocation has its technical aspects. Certainly the profession of Tool Engineering has many. It is sometimes a problem to decide just how far one might venture out on the limb. Competitive conditions in industry make it a certainty that tool engineers must venture out until they hear the limb crack.

Two articles in this issue, one by Dr. Ettinger, "Psychology in Industry" and one by Professor Horack, "The Making of a Tool Engineer" stress the benefits to be derived from the application of a wide range of scientific laws to the problems of tool engineering. If you feel that these articles overstress the importance of technical considerations, read the articles "Mathematics versus Common Sense" by a practical Tool Engineer (also an engineering graduate) John Markstrum, which is intended to point out some of the dangers incident to crawling out too far on the limb of technicalities. (Or does it merely point out the danger of not using properly the known laws of deflection and vibration?)

For specific illustrations of the correct application of the law study "Feed Pressures and Horsepower for Drilling and Milling" by Carl Oxford," Increase Production and Accuracy in Finish," by Larry Terbrueggen, and " Design for Production" by Prof. O. W. Boston.

These articles cover the subject of Tool Engineering from the standpoint of machines through materials and methods to man. It is likely, as Dr. Ettinger points out, that in the years immediately following, the best of our intellect will be gradually turned from considerations of the first three factors to the study of the most important in the list—MAN.

As the editor for this issue of THE TOOL ENGINEER my simple (?) task has been merely to get someone to write the articles appearing herein. Only the man who has written a technical article can appreciate the exacting and time-consuming nature of the task.

I am grateful beyond words for the splendid cooperation and excellent articles so generously contributed by the authors. I am sure the entire membership would like to have their thanks expressed here also.

These contributors are real men and outstanding in their several fields. What each has written, merits your attention.

DESIGN for PRODUCTION

By O. W. Boston

Professor of Metal Processing and Director
of the Department of Metal Processing, University of Michigan

By modern mass production methods, high-quality articles may be placed on the market at a price low enough to be within the reach of a large portion of the population. Equipment makes possible the use of less-skilled operators, and leads directly to more accurate work. The machine tool with its accessories plays a major part in this reduction of cost and perfection of quality. The standard of living of manufacturing operators in various countries varies with the development of machining and methods, being highest in those countries using machinery to the best advantage. Employment in manufacturing industries in this country has increased during the past fifty years at a rate greater than that of mechanization, and leisure and cultural advantages available to the employe during normal recent times are greater than ever before.

The purpose of this article is to outline a sequence of steps helpful in planning economic manufacture and to show the part played by the factors involved in the development of the product and equipment.

The virtue of innovation, whether machine, tool, or product, depends upon its design, the material, and the method by which it is produced. There is a very sensitive relation between these three factors. Their correlation may be obtained most satisfactorily in an organization complete in itself, in which the design, planning, and production are coordinated, by following a definite method of procedure as outlined in Table I.

Many times a product is developed by one party and then turned over to others for production under certain specified conditions. These others submit competitive bids on the stated production based on ways and means of manufacture selected by each of them. In this way, the development and design of the product are independent of the manufacture. To keep the successive steps interrelated, the following discussion is confined to the type of organization complete in itself.

Planning the Product

In planning the design of a product, it is usually the best procedure to start by making a series of rough sketches or layouts, as indicated by No. 1, Table I, to establish in the designer's mind definite values of proportions, size, appearance, and mechanical perfection. In those projects involving the mass production of comparatively inexpensive items or the low production of relatively expensive items, a thorough analysis at this point is very much worth while. Rough layouts frequently may be followed by the preparation of miniature or fullscale models. From such studies. the sketches may be revised.

Selecting the Material

As soon as the general size and shape of the article are decided on, the next step, as indicated by No. 2 in Table I, is to select the type of material of which each component part should be made. If one inexpensive device is needed, the designer may provide sketches bearing only important dimensions, and after explaining the use of the device, leave the selection of materials, fits, and tolerance to the convenience or judgment of the builder. If great cost or many parts are involved, every care should be given to the selection of the proper materials for each part, and all features of design should be set forth carefully. Various materials in common use are suggested in Table II. The designer must avail himself more than ever before of the many new materials constantly being developed. He must employ these facilities to meet the highly competitive conditions existing, as well as to select that material best suited to meet the requirements imposed upon it.

TABLE II
Material Used in Engineering Construction

1. Aluminum and its alloys (duralumin)
2. Carbides, tungsten, tantalum, titanium
3. Bakelite, resinoids, plastics, cast, molded, laminated
4. Copper-nickel alloys (Monel)
5. Copper-tin alloys (Bronze)
6. Copper-zinc alloys (Brass)
7. Cork and sound-deadening and heat-insulating materials
8. Fabrics, leather, etc.
9. Glass, Pyralin
10. Glues: animal, blood albumen, casein
11. Hard rubber, asbestos, fiber, carbon, etc.
12. Iron, cast, plain, and many alloys
13. Iron, malleable, various types
14. Iron, white
15. Iron, wrought
16. Lead, tin, zinc, and their alloys
17. Magnesium and its alloys (Dowmetal)
18. Paint, enamel, varnish, lacquer, Japan finishes, dopes, etc.
19. Rubber
20. Steel, cast, including many alloys
21. Steels, 107 types of the S.A.E. classification
22. Steels, stainless of several varieties
23. Steels, 13 per cent manganese
24. Steels, high-temperature
25. Steels, nitriding
26. Steel, tool
27. Steels, miscellaneous types.
28. Stellite

TABLE I
Steps in Planning the Design and Manufacture of a Product

1. Prepare rough sketches of the assembly and various component parts.
2. Select the type (analysis) of material to be used.
3. Select the fabricated form (bars, sheets, forgings, castings) of the material.
4. Determine the heat treatment or other treatments (annealing, hardening, plating, nitriding, cyaniding, etc.) of the material for manufacturing and the finished product.
5. Make computations for strength, rigidity, and review various parts for uniformity of sections, proportions, appearance, etc.
6. Prepare finished manufacturing drawings incorporating all features of design, select fits, and show dimensions and tolerances for each part.
7. Prepare routing sheets for each part, considering the number of parts to be produced. Set forth all operations in sequence to give the required accuracy and finish at the lowest possible cost, and indicate for each operation the machine tool, cutting tools, cutting fluids, jigs, fixtures, dies, measuring instruments, and gages to be used.
8. Design and make manufacturing tools and accessories.
   a. patterns for all parts to be cast.
   b. forging for parts to be forged or upset.
   c. Press dies for parts made in presses.
   d. die-casting dies, molding dies, etc.
   e. jigs and fixtures.
   f. measuring instruments and gages.
9. Estimate the production time for each operation and determine the number of each machine required to provide the desired rate of production.
10. Prepare the complete plant layout.

Some properties of major importance are strength, ductility, hardness, rigidity, lightness, resistance to wear, resistance to corrosion, resistance to friction, resistance to heat, electrical resistance or conduction, machinability, and appearance or sales appeal.

In many instances, the material best suited for a given part is not available, is too expensive, or is too difficult to work so a compromise may be necessary in favor of a second or third choice. The cheapest material actually may involve greater manufacturing cost than a more expensive material. For this reason, free-cutting brass rod often is used in screw-machine work for making small parts requiring no appreciable strength, in preference to much less expensive free-machining steel, as higher cutting speeds can be used. Low initial cost of the metal does not necessarily lead to low final cost of the article produced.

Selecting Fabricated Form of Material

Most materials are fabricated for use into convenient forms, as listed in Table III. Most metals are made into sheets, strips, bars, and extruded shapes in many convenient sizes and to accurate dimensions. A great tonnage of these forms is used annually. The fabricated form of the material indicates, in most instances, the type of process to be carried out in manufacture.

TABLE IIII

Forms in Which Various Materials May be Obtained

Standard Shapes	Rolled structural shapes, as beams, angles, T's, I's, and channels
	Plates over 3/16 inch thickness
	Sheets under 3/16 inch thickness
	Strips, hot or cold finished
	Bars over ½ inch diameter, hot or cold finished
	Wire under ½ inch diameter
	Tubes, welded and seamless
	Extruded shapes
Selective Shapes	Forgings or up-settings
	Castings, sand or permanent mold
	Die castings
	Molded plastics and resinoids

When the quantity of parts to be produced is small, they may be machined from solid stock or built up from sheet, tube, and bar stock, joined by various methods, such as riveting, welding, brazing, and soldering. Above a certain quantity, these methods of construction become prohibitive due to expense, and production processes of casting, forging, and stamping are employed. To illustrate, one part may be machined from solid stock or built up at a cost of $10. If ten of these parts are required, it may be worth while first to make a pattern of wood at a cost of $30, from which ten green-sand castings can be made at a total cost of $5. Subsequent light machining operations may cost an added $25, making the total cost for ten parts of $60, or a final cost per piece of $6. However, if one hundred pieces are required, a good metal pattern may be made, costing more than the short-lived wood pattern, but when pro rated over 100 pieces would cost less per piece. Refinement in the machine tool set up would reduce the unit cost of machining, while the material cost per piece would remain the same. The result is that each of the 100 pieces costs less than one of the ten. If greater quantities are required, other fabricating processes, such as die forging, stamping, or die casting, may be found to reduce the material cost and eliminate most of the machining formerly required. The high cost of the dies pro rated over the thousands of parts made would result in a very low unit cost.

Forgings of most metals from dies represent the strongest and most reliable form in which the metal can be prepared. They can be made close to size to reduce machining, but are limited to more or less simple shapes of comparatively small sizes not exceeding two or three hundred pounds. Forgings, heat treated after machining, provide very high strength. **Castings** of any metal can be made in almost any size and in simple or complicated shapes. They must be resorted to when extremely complicated shapes are to be produced. Metal can be poured into green-sand molds, dry-sand cores, or permanent metal molds to suit the size and shape of the work and the quantity required.

Stampings as produced by means of press tools from sheets or strip metal, combine high strength and light weight. With the wide variety of presses available and the opportunity of building so many types of dies, very complicated parts can be made in most any size in large quantities at relatively very low cost. These die operations consists essentially of blanking, punching, and forming.

Die castings are limited to low-melting-point metals, such as alloys of lead, tin, zinc, magnesium, aluminum, and copper, but are made in limited sizes and weight. The molten metal is forced under pressure into metal molds. Dimensions of die castings can be held to within 0.001 inch per inch length. Holes can be cored, threads cast, and smooth surfaces provided so that little, if any, machining is required to prepare the casting for use. Only light polishing or buffing is necessary before plating.

Many materials are hot or cold finished into **bar stock** for use in lathes, turret lathes, screw machines, and automatics, depending on quantities to be produced.

An illustration of the selection of proper material for making a simple screw in a hand or automatic screw machine from bar stock in which the free-machining properties are balanced against high physical properties, follows:

1. Free-cutting brass rod, very free machining, very low strength.
2. S.A.E. 1112 steel rod, free machining, low strength.
3. S.A.E. 1120 steel rod, slightly less free machining, stronger than No. 2.
4. S.A.E. 1020 steel rod, good machining, medium strength.
5. S.A.E. 1360 steel rod, fairly good machining, high strength.
6. S.A.E. 6150 steel rod, poor machining, very high strength.

Sometimes the designer does not select the materials of which the machine he is designing is to be made, but rather specifies those used in a previously built machine similar in general design and purpose, in which, by cut and try method, unsuitable and expensive materials have been eliminated.

Discussion of Materials and Their Forms

If parts of brittle cast iron are found to break repeatedly, they are replaced by ductile malleable cast iron or high-strength steel forgings or castings. Weight imposes limitations, and rigidity is of great importance. The designer of heavy machine tools, rolling mills, etc., is more interested in rigidity than he is in saving weight. Therefore, cast iron, cast steel, and plain carbon steel forgings are commonly used. The beds of machine tools, the frames of electric motors, and many like devices are made of heavy cast iron pieces or they may be built up from structural shapes and sheets by the process of riveting or welding. Welding is gaining in favor as

(Continued on page 26)

FEED PRESSURES AND HORSE POWER FOR DRILLING AND MILLING

By

C. J. Oxford

Chief Engineer, National Twist Drill & Tool Company

The design of Jigs, Fixtures and Machine Tools for the performance of metal cutting operations should be based on a fairly definite knowledge of the forces involved. Only through such knowledge can we so proportion our designs that these forces will be met and counteracted without undue deflection.

Deflection, Not Strength, the Factor

In designing Machine Tools and Work Holding Devices for successful metal cutting operations, it is not enough to provide adequate strength to guard against actual breakage; but machines and fixtures should be of such ample proportions that practically no deflection takes place under load.

Deflection is the greatest single factor to be guarded against, both as regards accuracy and alignment, and also as concerns smooth, continuous and long-lived performance of metal cutting tools. Chatter, the arch enemy of metal cutting, is nothing but the direct result of deflection in the machine, the fixture, or the tool itself.

This does not necessarily presume ungainly proportions, but does call for a careful study of the direction, location and magnitude of the forces involved, with adequate provisions to meet the forces at the points of stress.

As a concrete example, consider a milling operation where the feed is set at say, .003" per tooth of the Milling Cutter. Now, if the machine, the fixture, or the arbor, when under the load required, will deflect say, .006", it is evident that two teeth will slide over the surface, while the third tooth must dig in and remove .009" in one bite. It is this alternate sliding over and digging in that causes destructive chatter, that limits the rate of permissible feed and the quality of finish that can be obtained.

Forces Involved in Metal Cutting

Many independent investigations have been made of the forces and power required for various metal cutting operations, and with varying rates of feeds and speeds as well as varying materials. It is intended to present here some of the data thus obtained with the thought that the machine and tool designer may find guidance for his appraisal of the conditions under which the machine or fixture in question has to operate.

Drilling and Milling will be the two general classifications covered by this article:

A—Drilling

In drilling we are concerned with two main forces, namely thrust and torque. THRUST is, of course the pressure required at the end of the drill to make it bite into the material —in other words, the feeding pressure.

TORQUE is the turning or rotating force required. By considering the torque and time factors together, we find the power requirements for the operation in question and are able to express this in Horse-Power.

1—THRUST

The thrust values tabulated below are based on feeds given per revolution. For any other feed the thrust will increase or decrease with the thickness of the chip, though not in direct proportion. The exact formula, as determined by Professor Boston* being:

$\text{Thrust} = KF^{0.78}\ D$ for Steel

$\text{Thrust} = KF^{0.6}\ D$ for Cast Iron

where F is the feed in inches per revolution, D the diameter of the Drill and K a constant, determined from the machineability of the material to be cut.

THRUST FOR DRILLING

Diameter of Drill	Feed Per Revolution	Thrust—Lbs. Cast Iron	Steel
1/8	.004"	. . .	130
5/32	.0045	. . .	185
3/16	.005	. . .	245
1/4	.006	. . .	380
3/8	.008	. . .	550
1/2	.010	200	750
5/8	.011	275	1000
3/4	.012	325	1275
7/8	.013	400	1590
1	.014	500	1910
1 1/4	.016	700	2650
1 1/2	.016	850	3200

* University of Michigan.

When using these figures it should be kept in mind that they represent thrust loads for sharp drills, and that these loads will increase at least 50% before drills are dulled beyond practical usefulness.

It should be noted further that the values are given only for the two classifications of Cast Iron and Steel of average machineability. Thus when the materials to be drilled are of higher machineability a corresponding increase in thrust value will be apparent.

Within the practical range of machineable materials this increase in thrust will abount to 25% to 30%.

2—Horse-Power

The horse-power values given below are based on operating speeds of 100 and 60 surface feet per minute respectively for Cast Iron and Steel, and at the feeds given. For any other feeds or speeds the figures must be corrected to suit. The formulas for torque are:

$\text{Torque} = CF^{0.78}\ D^{1.8}$ for Steel

$\text{Torque} = CF^{0.6}\ D^{.2}$ for Cast Iron

where F is the feed in inches per revolution, D the diameter of the Drill and C a constant determined from the machineability of the material to be cut. With any other speeds than those given, the horsepower will be increased or decreased proportionally, provided the feed, drill diameter and material, remain the same.

HORSE-POWER FOR DRILLING

Diameter of Drill	Feed Per Revolution	Horse-Power Cast Iron 100 S.F.M.	Steel 60 S.F.M.
1/8	.004 "	. . .	.180
5/32	.0045	. . .	.240
3/16	.005	. . .	.310
1/4	.006	. . .	.440
3/8	.006	. . .	1.28
1/2	.010	1.60	1.65
5/8	.011	2.30	1.90
3/4	.012	2.90	2.35
7/8	.013	3.44	2.78
1	.014	4.02	3.20
1 1/4	.016	5.58	4.43
1 1/2	.016	6.10	5.00

At first glance it may seem that the figures for Cast Iron are too high; but this is because of the higher surface speed used.

Again it should be remembered that due allowance must be made for the increase in torque due to the dulling of the Drill, 30% to 40% is a suitable factor here.

Example

What thrust and horse-power loads should be provided for when drilling steel (average machineablity) with a ¾" diameter drill at 60 surface feet and with .012" feed per revolution?

Thrust= 1275 lbs. plus 50%=1913 lbs.
Horse-Power= 2.35 plus 30%=3.05 H.P.

B—Milling

The operation of milling, unlike that of drilling, does not lend itself readily to exact determination of forces. This is due to several things. First, that milling cutters vary so much in diameters, thickness and numbers of teeth, and second, that there are hardly two milling cuts of exactly the same depth, width and shape. Therefore, the cut per tooth and the volume and the shape of the chips are constantly varying from one job to the next.

The location and direction of the forces involved, as well as their magnitude are changeable factors, depending on the depth and nature of the cut.

True, these figures can be computed from existing formula, but this computation is too cumbersome to be of any real practical value to the designer or the shop man.

The only data that can be presented in an article of this nature are results of actual tests at various depths and widths of cuts. With this as a guide, the designer can estimate and interpolate for his own particular conditions.

The tables below give Horse-Power values for 2" and 4" per minute feeds and with speeds which are average for Cast Irons and Steels of mean machineability. Corrections must be made for any changes in either feed, speed or machining qualities. This must necessarily be a matter for individual judgment; but it is felt that the data given will serve as a guide in determining Horse-Power requirements for milling operations.

The direction of forces in milling as well as their relative magnitudes vary with the nature of the cut as stated earlier. It is, therefore, difficult to tabulate these. The following specific case may give an indication:

Depth of Cut.......... .5 inches
Feed..................2.00 inches per minute
Vertical Load.........15 lbs. upward
Horizontal Load........250 lbs.

With a shallower cut the vertical load will be downward instead of the lifting action indicated above.

The values given in the tables above are taken at the cutter so that no allowance is made for the friction load of the machine itself. This may vary from 50% on light cuts to 10% for heavy cuts. This must, of course, be added in order to determine the machine power input. A further allowance of at least 30% must be made for the increase in power requirements as the cutter becomes dull.

Before closing, there should be added a word about the importance of using milling cutter arbors of ample diameter. Deflection of arbors both torsional and bending, are very often responsible for chatter. When it is remembered that resistance to deflection increases with the fourth power of the diameter, the desirability of large diameter arbors becomes apparent at once.

POWER REQUIRED FOR MILLING

A—Side and Face Milling Cuts

Depth of Cut	Width of Cut	HORSE POWER Feed 2" per minute Cast Iron	Feed 2" per minute Steel	Feed 4" per Minute Cast Iron	Feed 4" per Minute Steel
⅛	½	.20	.30	.30	.45
	1	.35	.45	.55	.70
	2	.50	.60	.75	1.05
	3	.65	.90	.95	1.35
	4	.80	1.20	1.20	1.80
	6	1.10	1.45	1.60	2.20
¼	½	.30	.40	.50	.65
	1	.60	.75	.85	1.20
	2	.90	1.10	1.35	1.90
	3	1.15	1.40	1.65	2.60
	4	1.40	1.85	2.10	3.25
	6	1.90	2.40	2.75	4.20

B—Slotting cuts (Alternate Tooth Side Mills)

Width of Cut	Depth of Cut	HORSE POWER Feed 2" per Minute Cast Iron	Feed 2" per Minute Steel	Feed 4" per minute Cast Iron	Feed 4" per minute Steel
¼	⅛		.20		.30
	¼		.30		.40
	½		.40		.55
	1		.50		.70
½	¼	.40	.55	.70	.80
	½	.70	.85	1.00	1.35
	1	1.30	1.25	2.10	2.15
	1½	1.70	1.85	2.60	3.40
1	¼	.60	.75	.80	1.30
	½	1.10	1.40	1.60	2.50
	1	1.75	2.55	2.80	4.20
	1½	2.60	4.10	3.80	5.90

C—Slabbing Cuts

Width of Cut	Depth of Cut	HORSE POWER Feed 2" per Minute Cast Iron	Feed 2" per Minute Steel	Feed 4" per Minute Cast Iron	Feed 4" per Minute Steel
2	⅛	1.10	1.10	1.40	1.60
	¼	1.60	1.65	2.40	2.60
3	⅛	1.30	1.35	1.80	2.00
	¼	1.90	2.15	2.65	3.50
4	⅛	1.45	1.80	1.90	3.00
	¼	2.40	3.25	3.50	5.25
6	⅛	2.20	2.40	3.30	3.75
	¼	3.80	4.00	5.50	6.65

INCREASE PRODUCTION and ACCURACY in FINISH
by REPLACING OBSOLETE EQUIPMENT

By
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Chief Engineer
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At times there is a mistaken idea that extremely high production equipment does not produce as high a quality as can be obtained with equipment producing fewer parts. The following is an example of such an application.

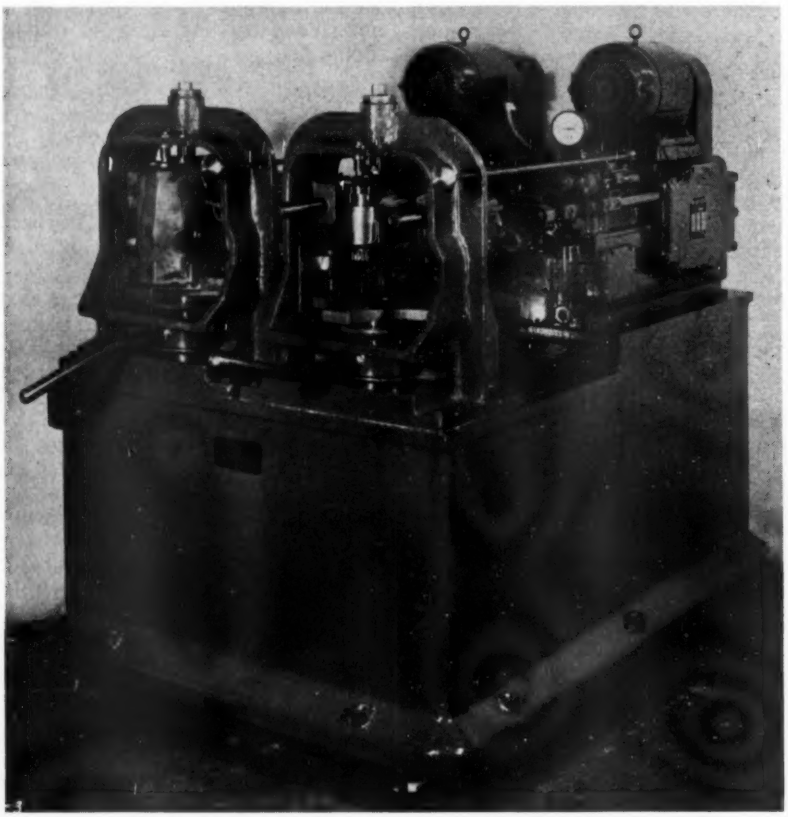
The operation in this case is rough and finish face gear seat faces on the inside of a Transmission Case. Prior to the introduction of the following method, this operation was performed by placing a spotfacing cutter inside the Transmission Case and feeding a drive bar through the counter-shaft hole by hand and then spotfacing to the proper depth. With one face finished, the part was turned end-for-end and the operation repeated. This set-up was also duplicated for finishing.

With the two-stage machine illustrated, this operation was changed to merely loading the part in one side of the machine where the roughing operation was performed, remove the part after the roughing operation, place in the finished stage and repeat the operation with one operator.

Instead of spotfacing, this operation has been changed to milling, making it possible to obtain a better finish and maintain greater accuracy as well as increase the cutter life.

The machine itself is made of three distinct units; the fixture, the angle drive head and the driving unit mounted on a welded steel base.

The drive unit is a standard square ram hydraulic unit. Each unit is individually motor-driven and is fed by means of a self-contained hydraulic circuit. The circuit used is of the closed type, using a low-pressure gear pump for rapid traverse, and variable delivery high-pressure pump for the feeding cycle. With this type of hydraulic circuit, it is possible to reduce the amount of hydraulic oil carried in the reservoir to a minimum. It also reduces the horsepower required because at no time is there any excessive amount of oil passed through the relief valve under high pressure. The only time it is necessary for oil to be passed over the relief valve is during the time of dwell at the end of the cutting cycle.



The right angle driving milling head is mounted on the hydraulic unit, being bolted to the flange of the square ram. An additional support is provided by pressing two heavy hardened and ground guide bars into the milling head. These bars register in the hardened and ground bushings in the fixture. This forms a positive tie-up between the fixture and the head and assures accurate alignment. It also tends to reduce vibration by decreasing the overhang. The body of the head is made of a steel casting. All gears, spindles and moving parts are made of alloy steel, heat treated and ground. The cutter-carrying spindle is mounted on taper roller bearings, the idlers on needle-point bearings. The driving power is converted from a horizontal plane to the vertical plane through spiral bevel gears.

Both the lower and the upper cutter are mounted on the spindle and adaptor piloting on a short-pilot, resting on the back face, and driven by means of a coarse thread. The upper cutter is mounted rigidly, the lower cutter being provided with vertical adjustment. This makes it possible to set the cutters to the correct overall dimension before they are advanced into the work. (The method of maintaining the correct height in the part will be explained in the fixture.) Necessary lubrication is provided. All moving parts are properly sealed against lubricant leakage.

In the design of any fixture to be used on a highly-productive machine, particular attention must be paid to the ease of loading, accuracy of location points and speed of clamping action, as well as disposal of chips. In the fixture used in connection with the above machine, an unusual condition existed, that is,

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Mathematics Versus Common Sense In Production Machines, Fixtures and Cutters

By

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Chief Engineer

Continental Tool Works

It is fairly well agreed that stress calculations should be used in almost every mechanical design; that the proper ribbing and bracing should be calculated according to the nature of the device, or rather, to fulfill the functions for which the device is intended. To this the proper factor of safety should be added. But, that's the trick!

Some professors and highly scientific designers claim that the factor of safety should be called the "factor of ignorance," as it is introduced for the purpose of covering up the shortcomings of the designer. Amen!

The purpose of this article is not to ridicule the "factor of ignorance" nor to belittle scientific knowledge as both can be put to the highest use in machine tools and fixtures, else, creaking, groaning and breaking of teeth become the order of the day.

Cutting tool manufacturers and machine builders have been playing hide and seek for decades. Cutters were hidden and machines would have been except that size prevented the latter from being so disposed. Tool steel cutting tools were no match for the glories in cast iron, shiny name plates and black paint that were our early metal cutting machines. With the discovery of high speed steel the order was reversed. Ouch! This hurt. Machines that had stood the ravages of two score and some years were doomed after one had really become used to them. What to do? Cutters were cheap but machines and space were expensive. The machine builder did some seeking and behold—new beauties in the machine world appeared with geared heads, silent chain drives, sanitary plumbing and the knee action reduced to a minimum. All was quiet on the western front when that eternal tormentor, the cutter man, uncorked a new horror—the cemented tungsten carbides—at a time when everything seemed so serene.

Now the joy was complete. The old machines wailed under the new duties imposed upon them, they shivered and shook, heated up, froze bearings and otherwise disported themselves in unseemly ways. Arming themselves with slide rules, radio groan detectors and anti-friction bearings, the machine builders again attacked and proved their "metal" against overwhelming odds. Many a monument of the machine builders art will be left to posterity and honored according to merit in the grand review.

The foregoing is a condensed narrative of the combined forces of mathematics and common sense as we know it in the production field. Now let us see what happens if we use only one of these at a time. Let's take mathematics alone.

We have altogether too many ancient and "mathematically correct" production machines. Wait. Now wait!—don't get your ire up too soon. What is meant by this is that too many ague-matics—you know the kind, or ought to—look too much like Hawaiian maidens going through their shimmies. Nothing breaks, unfortunately, which proves they are mathematically correct, but productivity and quality of finish suffer. So does that necessary evil, that undesirable appendage, known as the cutter. As chatter increases so does the mortality of the cutting tool in direct proportion and by no expansion of the cutter man's black art can a cutter be shipped with a sturdy machine attached for the price of only a cutter, although it might be warranted at times.

In the past few years a good many screw machine operations have been transferred to the drill press. Large combination tools requiring considerable power have been placed on small drill presses with long thin spindles, mathematically correct, for they broke not but the torque was excessive and naturally the tool was no good since it would not work. It had been designed to be used on a drill press. Size of press should cut no ice. Ah me! Milling machines are constantly in evidence chattering so badly that the cutter actually stops long enough in each revolution so that one can thoroughly examine its dental work. No cutter, no matter how well constructed, can give satisfactory performance under such adverse conditions.

To overcome weakness the machines are sometimes speeded up. The writer encountered a case in an up to date automobile factory where a high speed cutter was burning up. A check revealed a peripheral speed of 226 feet per minute on deep slotting in 1040 S A E forging. Speed was reduced to 90 feet per minute with three times more output and no cutter failure.

"Common sense" by itself is also erroneous. Correct proportions cannot be determined by the "looks" of a machine. Most of us have seen beautiful and strong-looking machines without "guts" in them. Plenty of horse power in the motor and more could be added but the chords and discords of the vibratory notes in the gearing were amplified by the resonance in the thin sections of base and column like that of a sound board in a piano. This, with the torque of undersize shafts and spindles, completes the wreckage as evidenced by the geneva motions of the change gearing rather than in the smooth performance desired.

Fixtures are another source of worry to the production man. As a rule they are designed by perhaps the most varied assortment of craftsmen. With the possible exception of ample chip egress, rigidity is the most important feature. Designers are prone to pay more heed to rapidity of clamping than to the proper support of the part. Fixtures are rarely too heavy but usually too light. Clamps bend and take a permanent set in a bent position, contacting the work in the most unexpected places.

Broaching fixtures are a grand example of what is meant by rigidity. More broaching failures may be ascribed to weakness of fixture than to improperly designed broaches. In general, granting that the cutters are right, the secret of successfully removing metal is rigidity of machine and fixture, causing the cutting tool to take a predetermined amount of metal per tooth, even if the factor of safety (or ignorance) has a new deal figure in its makeup. It is better if your machines are considerably overpowered than slightly underpowered.

The writer once condemned a small scale layout of an expensive special production machine as being too light for its purpose. The vendor replied that it was mathematically strong enough and guaranteed its

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PSYCHOLOGY IN INDUSTRY

By
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Tool Engineers are finding that they need exact information on the individual's reactions and personal relationship to others and to the plant equipment. For an excellent insight into this phase of production engineering, read this first article by an authority.

NOWHERE is emotional instability so evident as in the industrial field with its problems of high labor turnover, unrest and strikes. The recent epidemic of industrial conflict, including the significant sit-down strike of the United Automobile Workers against the General Motors Corporation—a campaign launched with vigor and pushed extensively in a number of plants—provides the most objective evidence of upheaval and disturbance in labor's ranks.

When men are difficult, unreasonable, irritable and demanding, there is always a cause. In fact all human behavior springs from fairly definite causes, but in labor difficulties the underlying and unknown factors are unrecognized by both employers and employees. In many industries there is chronic conflict, but it remains covert and concealed from the public except when the emotional lid is blown off and there is an eruption in the form of a strike. The fundamental forces that determine the conflict pattern are not apparent, and the utterances of the participants in the struggle are mere rationalizations of their difficulties.

Overt Emotional Expression

Back of any economic conflict there is a pervading unrest and discontent. With the growing complexities of modern civilization and the developing industrial life, the struggle becomes more intensified and militant. The strike situation is not created by the agitator. It is the result of a long background of stresses, strains and tensions. What the agitator does is to crystallize public opinion among the workers by making articulate the many forces already in existence: the pent-up emotions, suppressed desires, repressions, injustices and resentments which have been smoldering over a more or less extended period of time.

The group struggle is identified in the worker's mind with his own interests and status. It releases tensions and creates expectations, affords a medium for larger self-expression, and enhances the prestige of labor.

The strike, or the overt expression of conflict, is a technique of social control. It is a mass phenomenon and a state of mind, controlled by the basic standards of human desires. It represents a conventional device of organized labor, or working class mores, and in its manifestations is a collective refusal to work, and an active protest against the employer who refuses the union demands regarding recognition, wages, hours and other conditions. But the principal objective is recognition of the union as a collective bargaining agency, for upon the outcome of who shall control and what interests shall dominate, depends the status of the workers, individually and collectively.

The unpliant employer, reluctant to face the facts of modern industrial conditions, stubbornly persists in keeping labor in its place, and regards it as a commodity purchasable according to the laws of supply and demand. Any suggestion of yielding to the demands of the workmen or of granting anything that may appear like a concession is anathema to the management because it seems to challenge their authority to run their business as they see fit. It is a blow to their status and prestige.

From available testimony, it seems evident that many employers are reluctant to deal with organized labor for fear that by so doing they would be putting their heads into a noose and jeopardize their holdings.

Neither faction dares compromise because it feels that the slightest evidence of any willingness to arbitrate will be considered an admission of weakness, and if it loses it can expect no mercy. Rarely does a strike end with better feeling on both sides. Unless the strikers secure the satisfaction of all their demands, a spirit of discontent will prevail. Another period of unrest and agitation is likely to follow. There will be a rebirth of resentment, bitterness and collective action, and the conflict again emerges into a state of overt hostility. This action is repeated again and again and the cycle becomes a vicious one with the control of industry as the goal.

Modern Industrial Practices

At the present time, when industry is controlled by huge corporations with the management removed from the working force, and the control filters down through subordinates, the individual is submerged into a mere "hand." The corporation, in its impersonal relationship, fails therefore to sympathize with any efforts on the part of the occasional plant manager to work out industrial relations that furnish opportunities for the development of the worker's personality. When men are mere ciphers in the industrial plan and are not permitted to think or reason; when they are regimented and drilled into flat uniformity along certain lines of performance, there will be a tendency to seize whatever new opportunities chance to arise for the satisfaction of their repressed impulses. Even in the limited sense of pecuniary gain, industry cannot afford to be indifferent to discontent that is provocative of labor conflict.

Sharply opposed to the autocratic character of some industrialists who follow the traditional pattern, is the idealistic attitude of the well-disposed employers who recognize the rights of the individual worker. The

latter group regard diversity, originality and spontaneity as supreme contributions of society.

Personality tends to become more and more effaced and obliterated in the modern industrial scheme. Automatic toil makes men and women into mere factory hands and cogs of a wheel. They eventually reach a dead level of mediocrity. The intelligence of workmen must be recognized and enlisted in more diversified productive work by giving them responsibility commensurate with their intelligence and ability. Unless the worker has some share of the responsibilities and management and his latent powers are utilized, the well-springs of creative ability are atrophied, and craftmanship disappears.

Motives and Attitudes

Unrest and discontent are expressions of a thwarting of the fundamental wishes of mankind. The desire for recognition, for response, for new experience, and for security are basic forces in human life. In industry, especially since our recent economic dislocation, they represent such factors as fear of losing their jobs, uncertaintly of regular work, lack of personal recognition, too severe discipline, disagreeable supervisors or foremen, suspicious attitude on the part of the bosses toward the worker, and bad working conditions.

Lack of understanding between capital and labor is apparent in the two irreconcilable points of view. The worker's attitude is that the management is out to exploit him; that he will be discharged the minute work slackens without considering his plight, his emotions or feelings; and that pay per unit of work will be reduced if production increases.

On the other hand, employers assume that the workers have no right to poach upon their private regions of influence and control, and that unions exist as hostile associations determined to gain ends which the workers do not deserve, and of robbing the employer of the just fruits of his enterprise.

What does the worker want? The most dominant motives appear to be: to retain a self-respect, to express himself with a higher degree of attainment, and to be assured of certainty of work and those working conditions which will make possible the development of personality through the enthusiastic and satisfying performance of his work. Remuneration seems to play a minor role in the scale of values. Recognition, the opportunity for self-expression, and a demand for an adequate share in the control of the work are the prime motivating forces. This recalls to our mind the old artisan idea where the workman took pride in his tools and in the execution of his work, because he had means of injecting his personality in it. Today we have the reverse. The machine is the artisan and the worker the tool. The workman resents being cast into the role of "efficient tool." A solution can only be found by a method which gives adequate freedom to the worker within a larger coordinated unit.

Huge profits, displays of wealth, emphasis upon differences of education and culture as though these were the natural heritage of the rich, all tend toward increasing both the worker's feelings of inferiority, and the hatred through which his envy is rationalized.

Man Is Not a Machine

Unrest and instability are not so strange when we consider the wide range of variability in the characteristics of the worker with respect to intellectual capacity, educational accomplishment, physical characteristics, aspects of personality, and the like. The nature and extent of individual dierences are very complex, rooted as they are in psychophysical dispositions, the result of both nature and nurture. Significant differences have a marked influence upon the development and manifestations of ability and behavior.

A careful investigation of many plants would reveal such inconsistent factors as a workman with slow reaction time straining himself to keep up with a rapidly operating machine, a man with poor attention span trying to concentrate on a task that is too difficult for him, or one with such limited intelligence as to be unable to grasp the intricacies of his job, or to make the proper decisions. An individual may have the memory, requisite intelligence, or speed of reaction time for a given job, and yet he may lack interest, ability to apply himself, initiative, persistence, or other qualities so essential to successful accomplishment.

Labor turnover and the intelligence of employees are closely related. Tool making, for instance, is a grade of work that requires a high degree of skill and intelligence. Hence toolmakers of high intelligence tend to be more satisfied in their work than those of low intelligence. Again, the work of inspectors, which requires only simple operations, can be better performed by those of a more inferior intelligence. On the other hand, the machine shop requires an average grade of intelligence; consequently those of high and low intelligence are more dissatisfied than those of average intelligence.

But intelligence is only one aspect of personality. Even if a man has a given ability, as has already been indicated, it is not always certain that he is able to give the best of his ability to the job because of emotional factors. For instance, a disgruntled and unhappy man, working under distress and emotional strain, cannot accomplish as much as one who is adjusted. Even in industries, where economic motivation of **personnel work** is to the fore, it is recognized that the greatest efficiency is obtainable only when the worker is happy at his work.

Another major difficulty faced by the industrial worker is the age problem. Age specifications seem to be based upon the unwise assumption that the chronological age, or the number of years an individual has lived, gives an accurate evaluation of what the individual is physically and mentally. There is no scientific basis for such a pronouncement. Chronological age is not always identical with physiological or mental maturity. All men do not mature or decline at the same rate. In some instances, men of seventy are younger than others at forty-five. Organic changes are not so closely related to chronological age. During the World war, for instance, 500,000 men between the ages of eighteen and twenty-fice were rejected for physical disabilities, physically "too old" and worn out for active service; yet many men of forty and over were physically sound and adapted themselves very well to strenuous life.

When is a man considered senile, or too old? This depends upon the physical and mental state of the individual. Formerly when excessive physical labor and strain and long hours were usual for a vast number of employees, evidence of the effect was manifested in the worker of forty-fice or fifty years of age. But today, machines carry most of the burden, and the establishment of a chronological age limit of retirement is illogical and unfair.

Age should be no barrier to that person with average mental ability,

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WHAT HAS the TECHNICAL SCHOOL to OFFER the TOOL ENGINEER?

by

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TOOL ENGINEERING is a comparatively recent term which gives recognition to that branch of mechanical engineering which has to do with the economical production of articles on an interchangeable, mass basis.

The duties of the Tool Engineer are many and varied, yet as a whole they are quite closely related. These duties may be divided into two general groups, namely: the planning for and the processing of raw materials into the finished product, generally on a mass production scale. Each group calls for a wide knowledge of materials, design and manufacturing technic. Consideration of the cost of putting a given plan into operation and maintaining it on an economical level must always be weighed against the results to be obtained.

The Tool Engineer is an individual who has a good working knowledge of materials, design and manufacturing processes. Just how he is to gain proficiency in all the details of these major branches, which form the background for Tool Engineering, is a question for which there seems to be no simple answer. This matter has been discussed from various angles in several issues of this Journal during the past year. Each commentator has put forth reasonably convincing arguments for his particular line of approach. It is not the purpose of this article to try to settle this question, as the path that eventually leads to the position of Tool Engineer depends on many factors. Among the more important of these may be mentioned, (1) the individual himself, (2) the circumstances in which he finds himself, (3) his ambition and his method of attacking the problems that lead to his goal. In all previous discussions, it has been recognized that theoretical and technical knowledge as well as practical shop experience are essential to the successful Tool Engineer.

Much of our industrial progress, particularly during recent years, has in great measure been due to the application of the fundamental laws of physics, chemistry and mechanics. In many instances, the initial application of certain fundamental laws is not recognized, as the final results have been reduced to formulas, tables and graphical charts which form short-cuts to the solution of various problems, including the design of production equipment and the application of certain technical processes.

Specialized Knowledge Essential

In the design of much production equipment, including special machine tools, jigs, fixtures, dies, etc., previous designs and experiences are used as a basis for new designs. Formulas and tables used in previous designs are often used. However, some of these short-cut devices have certain limitations and modifications must sometimes be made. In some instances, formulas and tables which are found in some of the older standards books do not hold in the light of more recent developments. A knowledge of how these formula and tables were derived would, no doubt, permit a more efficient use of such short-cut devices.

When, where, and how this basic theoretical knowledge is to be obtained is a matter that must be adjusted to the individual. The course that leads to the position of Tool Engineer is not well defined. Most men, who, today find themselves in such positions have gone through a variety of jobs before attaining their present positions. Through years of varied experiences, they are able to solve quickly and quite satisfactorily many problems which might cause a less experienced man some trouble.

Because of the fact that the duties of the Tool Engineer are directly concerned with manufacturing processes, the number of Tool Engineers at present, who have come up through the school of practical experience, no doubt, outnumbers those who have a full college or technical school training to their credit.

The writer does not wish to imply that one group is better qualified for Tool Engineering than the other. Each group has had to overcome certain handicaps which the other did not possess. The college trained man, as a rule, lacks practical experience, while the shop trained man lacks the theoretical training. Whether it is more difficult for the college trained man to obtain a good all-around practical training, than it is for the shop trained man to get the necessary theoretical and technical training depends in large measure on the initiative and perseverance of the individual. The willingness to recognize his weak points and an appreciation of the abilities of his fellow workers have considerable influence on the progress of the would-be Tool Engineer. The conditions and environment under which he works are not always ideal; it may be necessary to make several changes in order to obtain a more or less well balanced training.

The Technical School

What contribution has the technical school to make in training young men for work in the field of Tool Engineering? No technical school professes to turn out a finished engineer, but it can and does give the industry some well qualified young men for further training.

The curricula of the average engineering school is fairly broad, and no doubt, includes a number of subjects which might be considerably curtailed or eliminated entirely insofar as direct application in Tool Engineering is concerned. Most students enter the regular engineering courses driectly from high school. They have had little

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PRODUCTION PERSPECTIVES

News of Mass Manufacturing from Everywhere

The settlement of the General Motors' strike has brought a sense of relief to many mass manu facturers in different sections of the country. The "sit down fever" manifest in many unexpected places has caused some "headaches" to production executives. However, the whole situation does not appear to cause too much alarm, as the feeling seems to be that even the strikes can't stop industrial activity and progress too seriously.

Strike influence has been reflected in the index of orders of the Machine Tool Builders Association. The record high index of 257.7 set in December 1936 was dropped to 200.3 in January. A large volume of business in this field is now pending, so that—with the settlement of present strikes—most machinery manufacturers will be virtually swamped with orders. Production Perspectives in different sections during the past month, are as follows.

New England

Production in **Western Massachusetts** is reported to have **suffered very little** interference because of the strikes. Producers of automobile parts there were fortunate in having outlets largely independent of the plants involved. Manufacturers of **tool steel** report that **no effect upon sales** of this class of metals was observed as a consequence of the tie-up.

Notwithstanding a steel price advance January 1 which occasioned much advance purchasing, the demand since then is said to have been unabated. **All leading centers of machine tool and hand tool manufacturing are** reported as **operating at a high level.** This applies to Springfield, Greenfield, Athol, and Worcester.

Production in the major industries of Western Massachusetts **is up to anticipations** and **in some cases better,** factory managers report. **The industry in general believes the improvement will continue.**

Hermann Waker, vice president and treasurer of the **United American Bosch Corp., Springfield,** said though the company is now in its dull period in radio manufacture, most departments are running at higher volume than in the same period of 1936. Production in general, he said "is satisfactory." He believes business will continue in good volume now that the automobile strike has ended.

Philip H. Bills, treasurer of **Gilbert & Barker Manufacturing Co., West Springfield,** said **production** for January was **"somewhat higher"** than January of last year. "It's been the best January in several years," he said. The rate of production is not so high as some of the months following July, 1936, when the volume was perhaps unusually large because of the delays caused by the March floods. "It is hard to say if the rate will continue," Mr. Bills said.

Col. Charles E. Speaks, president of the **Fisk Rubber Corp.,** Chicopee Falls said the rate of manufacture for January was about the same as for December, 1936. **He believes it will continue about the same for the next three months.**

James Y. Scott, vice president of the **Van Norman Machine Tool Company, Springfield,** said **production for this January was about 10 per cent higher than January, 1936,** and about the same as December 1936. It was "quite satisfactory" he said.

Dr. Edwin C. Gilbert, manager of Perkins Machine & Gear Company, Springfield, said that though his company always has a seasonal slump in January, **production was as good as last year. He looks for better business.** Business for the year, he said, is promising.

A reaction from the General Motors strike in the mid-west was felt at **Greenfield Tap and Die,** Greenfield, Mass., **President Frederick H. Payne, revealed.** While there were no orders being cancelled, there had been **notices received to hold up shipping orders.** Payne explained that while the corporation felt the direct effects of holding such orders, the diversity of its market made it possible for officials to easily take up the slack and not lay off any employees . . . **Employment in** the **East Springfield works of Westinghouse Electric and Manufacturing Co.** is reported as **at the all-time** peak of **5,700, of which approximately 5,100 are in the factory divisions.** This high level is made possible by a sustained peak production of refrigerators, and an increase of volume in the air-conditioning department, and the fact that none of the force in the small motors department, now numbering about 1,200 has yet been transferred to Lima, O., as arrangements for this change have not been completed . . . The business of the **National Equipment Company of Springfield,** in 1936 was "somewhat better" than in 1935, **George A. Bausman,** president and treasurer of the company reported following the annual meeting during which all directors and officers were re-elected . . . **Worcester is rejoicing over the end of the strike affecting General Motors Corp. plants. The strike cost Worcester** machine tool companies **thousands** of dollars **in cancelled orders,** or orders, the delivery of which had been made contingent upon the strike settlement.

Industrial production levels in Connecticut were well maintained as evidenced by a report of Bridgeport Chamber of Commerce indicating gains in weekly average payrolls as compared with the same periods of 1936. . . . **Manufacturers of electrical switches and appliances are experiencing heavy demand from** Midwestern **flood areas,** with **Trumbull Electric Mfg. Co.,** Plainville, **forced to go into overtime** . . . **Hartford Special Machinery Co.,** Hartford, of which **Joseph Merritt** is president, observed its 25th anniversary on February 9 . . . Contracts have been awarded for erection of the **new plant of Himmel Bros., New Haven,** in suburban **Hamden.** It will be one story, 150 x 200 feet, with an office wing, 300 x 100 feet . . . **Charles L. Jarvis Co.,** Gildersleeve, machine tools and hardware, **has bought** the **West Mills of the Portland Silk Co., Middletown. Russell Mfg. Co., Middletown,** has received increased orders from other sources which compensate for the recent loss of General Motors business and its **volume is equal to that of a year ago,** according to **President G. M. Williams** . . . **Chapman Machine Co., Terryville,** has been **operating 12 to 15 hours a day to keep up with orders,** and is **planning installation of new machinery soon in its newly-completed addition which doubles plant floor** space. . . . **Edward A. Burns,** long identified with the **Rowe Co., Plantsville,** in the manufacture of hard center calks, **died January 29.** . . . **Roger W. and Albert H. Gaess have formed the Gaess Mfg.**

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BRIDGEPORT

The Bridgeport Chapter of the American Society of Tool Engineers held a dinner and meeting on February 11, 1937, at Mary Journeys Inn, sponsored by the Bullard Company, at which there were seventy-five members and guests present. Oscar E. Koehler of the Greenfield Tap and Die Corp. gave an illustrated lecture on Screw Threads and gauges, and discussion followed.

CLEVELAND

P. F. Rossbach, Chapter Publicity Chairman, 898 E. 131st Street, Cleveland.

The January 19th meeting was very well attended. Mr. Hubbard spoke on "What Is Doing In Machine Tools." His talk was illustrated with slides of new machine tools.

He brought out that all plumbing and electrical controls were contained in the machines rendering them unnoticeable. The operator's controls were grouped together in the most advantageous position. Today the machine is being designed to fit the man. Design trend is toward more instrumentation so that pressures, speed, etc. can be read.

While every machine is special in one sense of the word, the trend today is to make them basically standard as possible. This was illustrated by a standard spindle nose for lathes and power units for drilling and grinding.

The February 16th meeting was also very well attended. Mr. Frank Curtis, of the Firth Sterling Co., spoke on "Tool Design and Tooling for Carbides." Many very good ideas were mentioned and these illustrated with slides of the design of the tool and also the actual tool in operation.

This was one of our most interesting meetings and we will look forward to another visit by Mr. Curtis.

The next meeting will be on March 16th at the Colonial Hotel. This will be election of officers and every member is requested to attend.

Until further notice the meeting day will be the third Tuesday of the month.

HARTFORD

F. L. Woodcock, Chapter Secretary, 52 Imlay Street, Hartford.

The January 27th meeting of the Hartford Chapter was called to order at 8:00 P. M. in the Auditorium of the Hartford Gas Company,—Chairman A. H. d'Arcambal presiding. There were seventy-eight members and friends present.

Joseph M. Barr, Factory Manager of the Chance Vought Aircraft Company addressed the meeting, his subject "Tools for Airplane Manufacture" being of deep interest to all. He explained in detail all tools needed in the production of all-metal ships—with complete interchangeability, one model requiring no less than 5,000 dies, jigs and fixtures.

J. Carlton Ward, Jr., Assistant General Manager of the Pratt & Whitney Aircraft Company gave an exceptionally comprehensive address on the basis for tooling for manufacture of air-cooled aircraft engines. He covered the entire field fundamentally and explained details necessary to the satisfactory production of what is probably the most intricate and precise piece of machinery extant: the aircraft motor.

Both talks were fully illustrated by splendid stereoptican slides.

A dinner was enjoyed by a number of members and guests at the City Club before the meeting.

MILWAUKEE

E. E. Houston, Chapter Publicity Chairman, 1029 So. 35th St., Milwaukee.

Another month and another fine meeting. Your correspondent for the Milwaukee Chapter has to control his enthusiasm. Our A.S.T.E. meetings are certainly worth attending.

The February meeting was held in the Republican Hotel, one hundred and twenty members being present. Chairman Smart started things off with a lively black board discussion. During this feature the subject of stripper bolts and the different methods of holding strippers in place was carefully discussed.

Mr. Seeger, of the Stanek Tool & Die Co., seemed to be very partial to shoulder bolts, whereas Mr. Smart was of the conviction that a bolt threaded into the stripper was the cheapest and the best way of doing the job. We understand that this is one argument that has not been settled by these two gentlemen.

Following the black board discussion we had the pleasure of listening to a very well informed speaker, Mr. E. J. Bryant of the Greenfield Tap & Die Co., who took many difficult problems in tapping and threading and made them look very simple. We feel that there were a few changes made in some Milwaukee shops the morning following the meeting. Member Louis Niemcheck of the Vilter Mfg. Co., brought in a tap of unusual design, perhaps with a little persuasion Mr. Niemcheck would write about it for "The Tool Engineer."

After hearing the informal discussions offered by our fellow members we most sincerely disagree with the party who wrote "a tool engineer is a genius on his seat but a .... on his feet." We would gladly back up our point with speakers such as Messrs. Sedgewick, Seeger, Schaefer, and many others.

Messrs. L. J. Radermacher and Eldred A. Rutzen were elected to the nominating committee.

The Milwaukee Chapter held their mid-winter rally at Club Madrid, January 29, 1937.

Art Johnson of Cutler Hammer, exchequer of the Milwaukee chapter was all smiles, the party was a financial, as well as social, success.

You have to give those two pilgrims from the North, Gideon Kane and Al Gerhke of the Northwest Engineering Co., Green Bay, Wis., a big hand. They never miss any of our "affairs."

We noticed that Hank "Cutters" Peters relaxed for the evening. Was that a testimonial dinner, Hank? (He seemed to be entertaining lavishly at his table.)

The Waukesha delegation was there and how! Messrs. Frank Burdick, E. J. Longrie, Max Eiserman, A. A. Herzberg and Fred Gebhardt helped put it over.

That man from the South, Art Regan, South Bend, Ind., informed your correspondent the rallies should be bi-monthly.

We wish to thank the Committee who strived to make this affair a great success.

RACINE

T. J. Santry, Chapter Publicity Chairman, 1615 Racine Street, Racine.

About eighty-five (85) local engineers and guests attended the regular monthly dinner meeting of the Racine Chapter, American Society of Tool Engineers, held Monday night, February 15th, at 6:30 P. M. in the main dining room at Hotel Racine.

The main speaker of the evening was Mr. T. B. Buell of the Sund-

(Continued on page 34)

HANDY ANDY'S ..WORKSHOP..

Detroit Tool Engineers and their ladies who heard Dr. E. De Witt Jones' talk on Lincoln got the real lowdown on what it takes to stand up under criticism. Of course, the best way to avoid criticism is never to do anything; the next best, is to be a good politician. That lets me out—anyway, that's what they tell me.

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"Never write a letter when you're mad," the speaker said in effect, among other things. That reminds me of the time one of the boys put me on the pan for something or other I'd written in "The Tool Engineer." His letter of criticism stung me, so I just smeared the ol' typewriter ribbon in tobasco sauce and wrote an answer. It sizzled!

That was at night (I work days) and next morning the envelope looked crisp and brown, like toast. "Too hot." It went into the waste basket. That night I wrote another, and another, each one getting milder until the last was so emasculated that it looked like an invitation to a pink tea. My critic never did get to know what a masterpiece of hot retort he missed. The funny part of it is that after I'd gotten it all out of my system I really liked the guy. Hope it goes both ways.

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You know, I just feel like rambling along this time, seeing as my term of office as Chairman of this Editorial Committee is about over. My swan song, like, along with my job as Sec'y. of Detroit Chapter. Between everything, it's been a busy year, but it's had its compensations. I have become acquainted with oodles of fine and splendid men, men whom I hope to number among my friends when I have time to mix with them, to learn to associate faces with names.

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That is among my failings, that I have to be introduced a few times before it clicks. Even my wife insists that I had to be introduced to her four times before I got really acquainted. The charge, by the way, is greatly exaggerated. It was only three times. I wanted to be sure it took.

You know, this A.S.T.E. gets into a guy's blood, in a way. It has something, and that is why men work for it, why it just grows and grows. It is a FRIENDLY society, with just about the right proportion of work and play, the right mixture of the technical and the general, in subject matter. It is just what Tool Engineers need to broaden their technical training and to expand in liberal education, to learn how to express themselves and to sell ideas. One of the best ideas the A.S.T.E. is selling is that the Tool Engineer is one of the most essential cogs in our present industrial civilization—this Machine Age.

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One result of that selling talk is that the technically trained man is coming into his own, a process that will be greatly accelerated as the Society grows. And how it grows! Even now, there is a scarcity of really competent men, and it is a safe prediction that before the year is out Tool Engineers will be enjoying a prosperity heretofore but the vision of a rainbow chaser. There is a reason. The American Society of Tool Engineers is the only engineering organization, taking in men in all walks of the profession from the student to the big executive engineer, that has given management essential benefits without demanding anything in return except that its work be given consideration. It has sold itself on SERVICE, and inevitably its membership will reap the rewards of service.

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Did you ever stop to consider the work of the Standards Committee?—the obstacles it has faced, the sales resistance it had to overcome at the beginning? Only the men who have worked on that Committee really know what it has taken, in long hours, in painstaking research and checking, in dictation and correspondence, to put the A.S.T.E. Standard Sheets across. And, the work goes on, but now with added zest as responses from manufacturers encourage the Standards Committee to greater efforts. These Standard sheets are WANTED. They save time and money all around—they are not only silent salesmen for mechanical equipment, tools and machinery, but the most reliable and readily accessible references so far designed for the engineer.

I would like to give tribute to many A.S.T.E.ers who have given so freely and willingly of their time and energies to the Society; to Ford Lamb, retiring President, for his tenacity of purpose, his able leadership in this first year of the A.S.T.E. as a really national organization. I'm proud to know you, Ford. Fortunately (I have a hunch as to who the next Prexy will be), a big caliber man succeeds him. The good work will go on.

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I wish, especially, to thank my Detroit associates—fellow officers, committee members and ticket sellers—for their fine cooperation during a busy year. And the various technical editors, for the excellent articles they presented to our readers, nor forgetting the critics, pro and con, of some of the articles and editorials that I wrote personally. Now it can be told; many of those articles were written with the express purpose of inviting comment—the sharper the better. Last but not least, my highest regards to Mr. Roy T. Bramson, publisher of "The Tool Engineer," for his unremitting work in making it an outstanding engineering journal, for his keen interest in the Society, his success in promoting new chapters. It has been a pleasure to work with you, Roy.

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Speaking for myself, I have one big regret—that I can't complete my Hall of A.S.T.E. Fame. I see now that I shouldn't have started it—I put too few in and left too many good men out. But then, there is nothing to cramp the style of my successor —let him carry on! It's lots of fun, once you get the hang of it.

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In closing, a silent toast to a friend, to a friend of many of our members. I don't even know if he was a member—he probably wasn't —but he was a fine man, a fine tool engineer, a loyal friend and a Christian gentleman, and, posthumously, he goes into my personal Hall of Fame. To Charles (Chuck) Sweeney, long with General Motors, late Chief Tool Designer of Swartz Tool Products Company. Gentlemen, break your glasses.

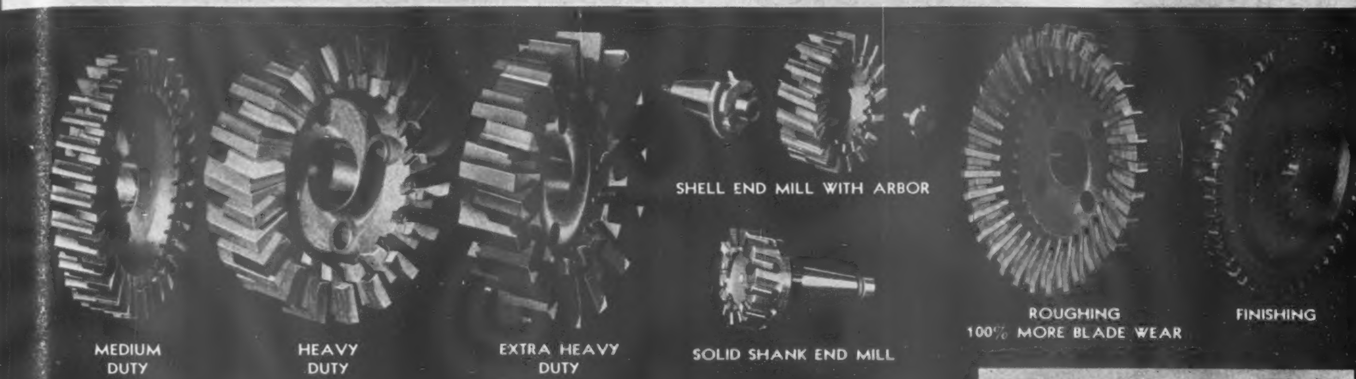
▼ ▼ ▼

And now, 'til we meet again in the pages of "The Tool Engineer."

Handy Andy.

INGERSOLL *Inserted Blade*

CUTTERS FOR ALL PURPOSES



INGERSOLL ZEE LOCK FACE AND END MILLS

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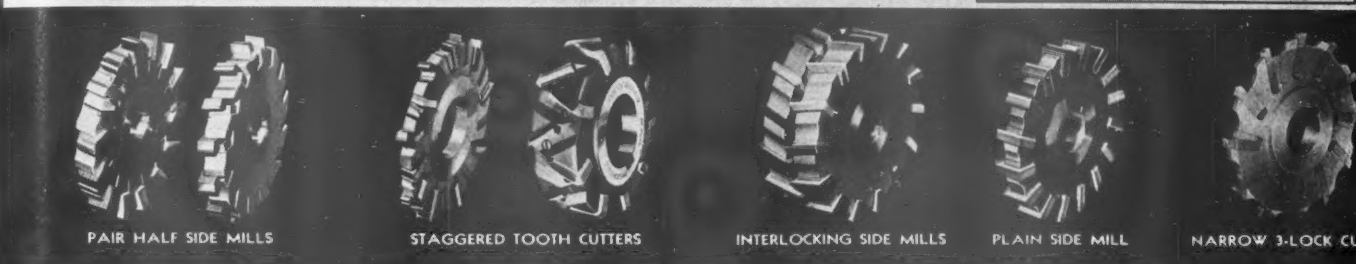
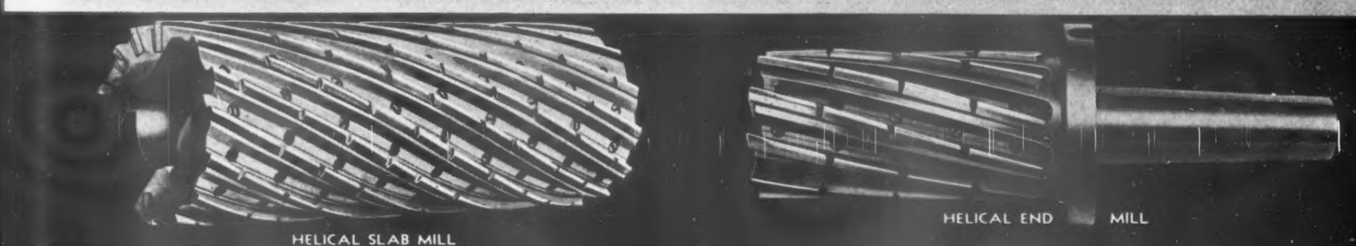
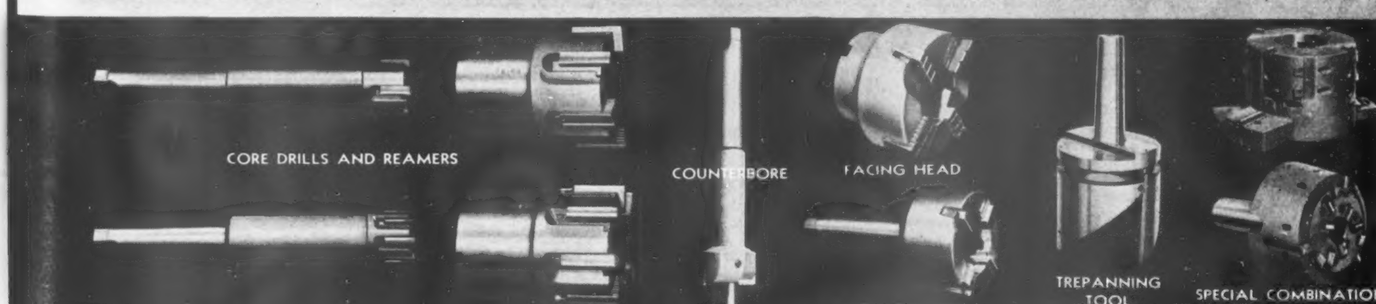


INGERSOLL ZEE LOCK SIDE MILLING CUTTERS



INGERSOLL INSERTED BLADE HELICAL MILLING CUTTERS



INGERSOLL MULTI-BLADE CUTTERS

Let Ingersoll be your Tool Engineers—WRITE FOR COMPREHENSIVE INGERSOLL CUTTER CATALOG

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MARCH CHAPTER MEETINGS

Chapter Meeting Announcements must be received on or before the 20th of preceding month. Omissions are the result of not receiving this information by this date—in time for publication.

BRIDGEPORT

March 11, 1937—Steak dinner: 6:30 to 7:30—85c per plate. Mary Journeys Inn, 336 Fairfield Ave.

Speaker: MR. ALEXANDER H. d'ARCAMBAL, Pratt & Whitney Company, Hartford, Connecticut.

Subject: "New Developments in Metal Cutting Tools and Gaging Practice."

Mr. d'Arcambal's talk will be illustrated with lantern slides and a number of interesting specimens will be presented. Some time will be devoted to chromium plating, nitriding the hard carbides, etc. This meeting will be sponsored by the Underwood-Elliot-Fisher Company of Bridgeport, Connecticut.

CHICAGO

Note—There will be two meetings in March

March 8th, 1937—Machinery Club, 571 W. Washington Boulevard. Business Meeting: 8:00 P. M.

This meeting will be devoted entirely to the transaction of business and the election of officers for the Chicago Chapter, and will be attended by members and prospective members whose applications are on file. A full attendance is expected.

March 22nd, 1937—Machinery Club, 571 W. Washington Boulevard. Dinner: 6:00 P. M. Technical Session: 8:00 P. M.

Speaker: Mr. A. H. d'ARCAMBAL, Chief Metallurgist, Pratt & Whitney Company, Hartford, Connecticut. Chapter Chairman, Hartford Chapter.

Subject: "Important Developments in Cutting Tools and Gaging Practice."

This topic will be illustrated with slides.

Make reservations with Mr. Willard T. Wilson, Chapter Secretary, at 7428 Euclid Avenue, Chicago. Early reservations will insure dinner places at this unusually interesting and practical meeting and discussion.

CLEVELAND

March 16, 1937—Dinner: 6:30 P. M.—$1.00 per plate. The Colonial Hotel—823 Prospect Ave.

ELECTION OF OFFICERS

There will be no speaker at this meeting as there will be election of officers. All members both Senior and Junior are requested to be present and bring guests. Make this a get acquainted meeting and have a rousing good time.

Make reservations with Mr. G. J. Hawkey, Penton Building, Telephone Main 0112, to insure a dinner place.

DETROIT

March 11, 1937—Chrysler Corporation—Administration Building, Massachusetts and Oakland Avenue (Highland Park). Members only—Guests are not invited to this business meeting. Dinner: 6:00 P. M.—Chrysler Cafeteria—Business Meeting: 7:45 P. M.

Inspection Tour of Engineering Buildings and Laboratory (upon conclusion of business meeting)

Detroit Chapter on this occasion is the guest of the Chrysler Institute of Engineering. A splendid dinner is being provided for A.S.T.E. members. All those who plan to attend the dinner and this important business meeting and inspection tour of the Chrysler Laboratories should, without fail, notify A.S.T.E. offices at 5928 Second Boulevard, Detroit. Dinner places cannot be assured for those who fail to do this.

MILWAUKEE

Regular monthly meeting of the American Society of Tool Engineers to be held at the Republican House in the Colonial Room, March 11, 1937

Speaker: MR. W. E. CONKRIGHT, International Harvester Company.

Subject: "Operation and Problems of the Diesel Engine." Illustrated with sound pictures.

Dinner 6:30—$1.00 per plate. Make reservations early.

PITTSBURGH

March 12th, 1937—Dinner: 6:30 P. M.—Courtesy of the Motch & Merryweather Machinery Company, Fort Pitt Hotel

Speaker: R. E. W. HARRISON, Vice-President, Chambersburg Engineering Company, Chambersburg, Penna.

Subject: "Forgings and Forging Equipment."

NOTE: To make reservations, please call Mr. E. C. Batchelar, ATlantic 3985 not later than noon March 11th.

Design for Production

(Continued from page 11)

a substitute for riveting. High-pressure tanks, ships, bridges and buildings, machine tools, and jigs and fixtures are being constructed of welded sheets, plates, and structural shapes of steel.

TABLE IV

Examples of Materials and Processes Used for Making a Gear Under Various Conditions

1. Plastic (Bakelite, fiber, etc.) with machined or molded teeth in lamellar or molded material for high or low speeds, light loads, quietness, and dielectric properties.
2. Die casting alloys: accurate dimensions, good surface finish, complicated shapes, large quantities. Properties and cost indicate type of alloy, as lead, tin, zinc, magnesium, aluminum, copper, etc.
3. Cast Iron: cast or machined teeth for comparatively light loads, slow speeds, low cost.
4. Brass: machined teeth for light loads, slow speeds, non-corrosive.
5. Bronze: machined teeth for heavy loads, high speeds, non-corrosive.
6. Low-carbon steel: machined teeth for comparatively light load, slow speeds, low cost.
7. Low-carbon steel: machined and hardened teeth for high loads, high speeds, low cost
8. Low-carbon steel: machined and hardened and ground teeth for high loads, great speeds, quietness.
9. Alloy heat-treated steels: for high loads, heavy duty, high speeds, 1030, 1045, 2315 carburized, 2515 carburized, 3215 carburized, 3230, 3245, 4615 carburized, and 6115 carburized

Low cost, low modulus of elasticity, ease of producing complicated shapes, low shrinkage, good machinability and wearing qualities recommend cast iron. It is usually selected for cylinders for engines and compressors, because of its good wearing qualities. Cast iron is produced in many ways and in many grades. The International Nickel Company recommends a total of fifty alloys of nickel or nickel and chromium for specific uses. Molybdenum, chromium, vanadium, titanium, and other alloying elements also are used advantageously. Where greater ductility is required, malleable cast iron is used. Cast steel is substituted where greater strength material is required or where low weight is essential. Steel forgings for parts in quantities of comparatively simple shapes and limited weight replace steel castings. Forgings, containing various alloying elements when properly heat treated, furnish very desirable physical properties.

The designer of automobiles and airplanes is interested in high strength-weight ratio and, therefore, uses high-strength alloy steel heat treated, high-strength light alloys of aluminum and magnesium, and, where possible, sheet steel formed to the desired shape. Large parts are built up of sheet steel by riveting or welding. Forgings of steel are used where practicable instead of castings. Cast iron is replaced by the stronger and more ductile steel castings, except for use as cylinder blocks or pistons. Where the machine involves high speeds and high power, alloy steels are introduced for gears, shafts, etc. Table IV illustrates the selection of types and forms of material for a gear to meet various requirements.

Additional materials used in aircraft construction are canvas, linen, silk, leather, wood, plywood, glues, rubber, and sound-deadening and heat-insulating compositions. Airplane ribs and wings may be made up of nailed and glued wood structures, riveted aluminum alloy

(Continued on page 34)

Problem: check skiving tool
Solution: J&L Pedestal Comparator

The shell band skiving tool, shown below, presents the complex problem of checking a combination of surfaces and angles in relation to one another. The solution to this problem has been found—it lies in the use of the J&L Comparator.

To check this tool the chart glass on the Comparator is ruled with right angle lines intersecting at the center. One line is perpendicular to the table top when the chart ring is set at zero.

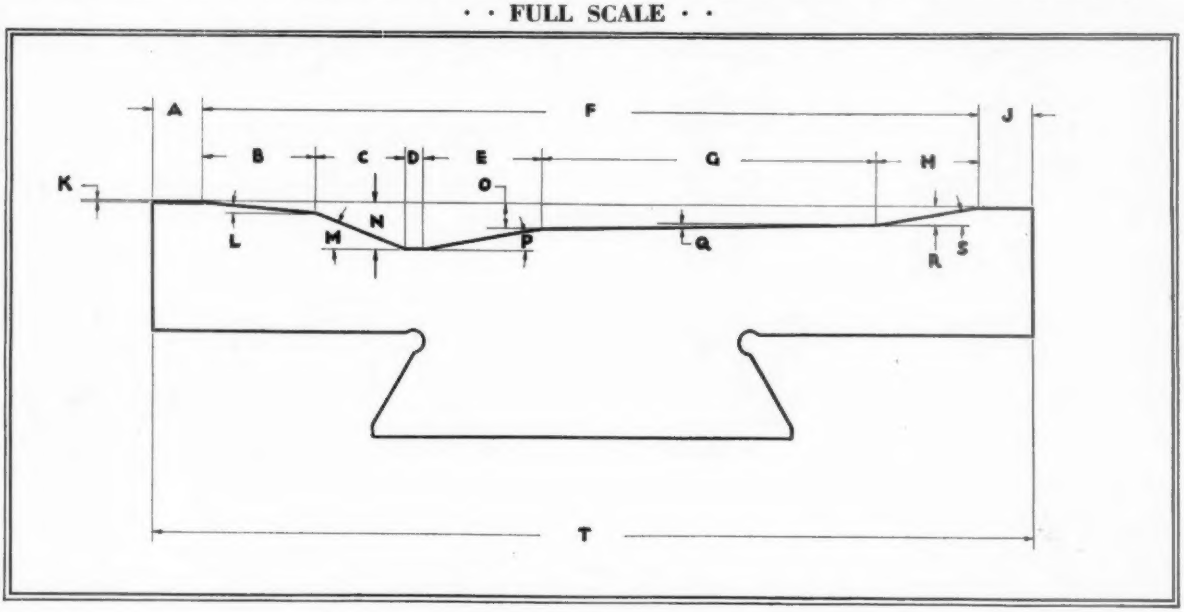
The lateral dimensions, "A," "B," "C," "D," "E," "F," "G," "H," "J," and "T," are measured by setting the shadow of the side of the tool to coincide with the vertical line on the chart glass. The table on which the tool is mounted is stepped over to match the shadow and line for each dimension to be checked. These dimensions are measured with size bars and the built-in micrometer. Any error may be read directly from the micrometer.

Dimensions, "K," "N," "O," and "R," are checked by matching the shadow of the tool to the horizontal line on the chart glass. By raising or lowering the table, the tool is stepped up or down to check each of these dimensions. All vertical dimensions are read directly from the dial indicator on the vertical measuring attachment.

The angles, "L," "M," "P," "Q," and "S," are measured with the vernier segment and the graduated ring around the chart glass. Either the horizontal or vertical line on the glass is turned until it coincides with the shadow of the side of the tool. Any error may be read directly on the vernier in degrees and minutes.

Let us show you the ease with which the J&L Comparator can solve one of *your* complex inspection problems. There is no obligation.

· · FULL SCALE · ·



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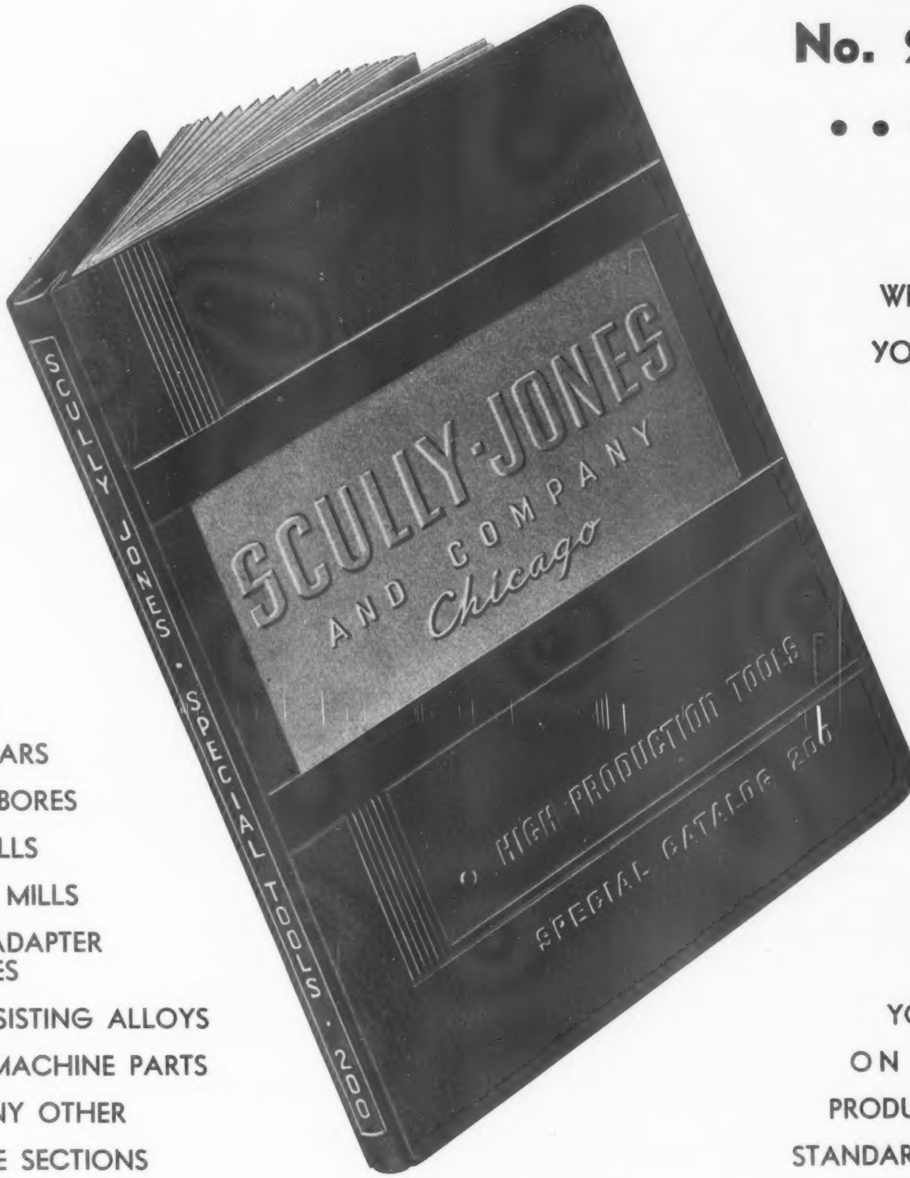

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Technical School Offers

(Continued from page 18)

or no practical experience and most of them have no definite idea what they expect to do after completing their college courses. There are, of course, some who have found it necessary to work in industry for several years before starting their technical training. These young men generally have a more definite objective in mind and are better able to see the advantages to be gained fro ma systematic technical training.

Most engineering courses generally provide as broad a training as possible within a four year period. Major emphasis is first placed upon such fundamental sciences as, mathematics, physics and chemistry. Later they are shown how the fundamental principles of these sciences are applied in the design of machinery, mechanical and electrical power and transmission equipment, etc. Such subjects as machine shop practice, pattern and foundry work, heat-treatment and metallography of metals and machine design, with which the Tool Engineer will be most concerned are often confined to the second and third year. Unless he has made some industrial contacts through, perhaps, summer work in some factory or has received proper vocational guidance for his future work, the student is apt to enter his last year of college with still no definite objective. However, he now begins to realize that he must begin to think about the future and very often his future choice is influenced by the nature of the courses he pursues during his final year.

Tool Engineering—a Profession

Tool Engineering, it was stated, is a relatively new term applied to a particular phase of mechanical engineering and its significance has, as yet, not been fully appreciated by engineers in general. Even many engineering educators, do not seem to have a clear understanding of the duties of the Tool Engineer and what kind of training offers the best preparation for this type of work.

Those technical schools which are located in or near the large manufacturing centers have sensed the demand for more specialized training in those subjects pertaining directly to Tool Engineering. Such schools have, during recent years, placed additional emphasis on metal processing, planning and the design of production equipment and such other courses that will be beneficial to those intending to go into Tool Engineering as a profession.

The teaching staffs of many of these schools have become conscious of the importance of the advances in modern production processes and are making a definite effort to convey as much of this information to their students as possible. The result has been a decided improvement in the technical graduate's knowledge of production methods.

Practical Experience Needed

It is true that in the technical school, actual shop work of various kinds is more or less limited, depending on the extent of the equipment and time available. The previous experience and interest of the instructor is also an influencing factor.

In most cases, the student can be familiarized with fundamental principles only, if any variety of work is to be undertaken. An important factor is, that an analytical attitude is developed, which is often diffi-

(Continued on page 38)

✶ LETTERS ✶

Vandyck Churchill Company
114 Liberty Street
New York City
February 19, 1937

Mr. Ford R. Lamb, President
American Society of Tool Engineers, Inc.,
5928 Second Blvd.,
Detroit, Michigan

Dear Mr. Lamb:

I have word from our good friend Jim Weaver, Director of Eqpt. Inspection and Tests of the Westinghouse Electric and Manufacturing Company at East Pittsburgh that you fellows have organized a society of tool engineers in the Pittsburgh territory. Now Jim and I are old friends and when I was in Pittsburgh around the first of the year we talked over the possibilities of also organizing a chapter here in Newark, N. J.

I have already talked to a number of tool men here who are keenly interested in the idea and they have asked me to get complete information from you which will tell exactly what is to be done and how we are to go about doing it. Mr. Weaver says that 25 members are necessary in order to organize and I want to assure you I do not believe we will have any difficulty at all in starting out with this number. As a matter of fact we may be able to do even better than this.

Won't you kindly let me know at your earliest convenience if you are in accord with this idea and what we have to do to get started, and oblige.

Yours very truly,
HDH;K *H. D. Hall*

We will be, indeed, glad to work with you Mr. Hall in the establishment of a chapter of the A.S.T.E. in Newark. Officials of the national headquarters of The Society have been duly advised and no doubt by this time your chapter is well under way.—Editor.

▼ ▼ ▼

3815 Glenmore Ave.,
Baltimore, Maryland
February 16, 1937 L

American Society of Tool Engineers,
31 Melbourne Avenue
Detroit, Michigan

Gentlemen:

It is with great pleasure that I see the A.S.T.E. grow and regularly add new chapters, and it is only natural that we should like to have you grant a chapter to Baltimore. We have several large industrial concerns such as The Glenn L. Martin Co., Crown Cork and Seal Company, Bethlehem Steel Corp., and we are just 40 miles from Washington, D. C. where there are a number of engineers employed by the government.

There are at the present time fifteen to twenty prospective members in Baltimore and this number could easily be doubled or trebled if you are interested in organizing a chapter here.

I will be very glad to work with you and other members of A.S.T.E. in this city for the purpose of organizing a chapter.

Very truly yours,
Nils H. Lou

Enclosed is check for 1937 membership.

We share your pleasure in seeing the A.S.T.E. grow, Mr. Lou. We have asked the proper officials to communicate with you relative to a chapter in Baltimore and vicinity.—Editor.

Design for Production

(Continued from page 26)

shapes, or of spot-welded stainless steel shapes. The fuselage and landing gear are usually made up of welded steel tubing, with the highly-stressed members of chromium-molybdenum steel, while the lower-stressed tubes are of plain medium carbon steel. Sometimes riveted duralumin is used. Gasoline tanks are made of welded pure aluminum sheet.

The concluding installment of this article by Prof Bos.on will appear in an early issue—Edito:.

A. S. T. E. Chapter News

(Continued from page 20)

strand Machine Tool Company of Rockford, Illinois, who talked on "Turning, Milling and Design." He illustrated his entire talk by using about 4000 feet of film. Quite a number of intricate turning and milling operations were shown by film and after each operation was completed a chart indicated the speed and feed used, kind of cutting tool, and number of pieces produced per hour at 85% efficiency, all of which, of course, was interesting to the engineers present.

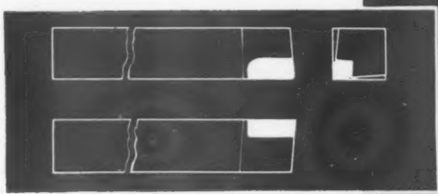
TRY-OUTS

"One of the things we learn as we get older is how many more things there are we don't know. I knew more when I graduated from high school than I have ever known since. But I am glad I knew it once. But that never bothers the fixers. They are too cocksure about things. There was a lady at a dinner party sitting next to a nice looking gentleman, and she said, "What is your profession?" And he said, "I am a Naval surgeon." And she said, "My, how you doctors specialize." There was a lady who had a canary. It was her second canary. She had to get rid of the first one because it was too close to the radio and learned a lot of static. The canary sang beautifully but all at once it wouldn't sing any more, so she took it to the bird store to see if they could find out why it wouldn't sing. And the man said, "Madam, your bird needs a mate." And she said, "But I don't know whether it is a male or female." And he said, "I will tell you how to find out. Put two worms, one male and one female, in the cage. If the bird eats the male worm it is a female, and if it eats the female worm it is a male." "But how can I tell if the worm is male or female?" "Madam, this is a bird store. You will have to go to a worm store for that." He was highly specialized. You know, there is a way to tell a male worm from a female worm. The worm will turn but a female worm never signals before it turns.

"Now the third undesirable class of neighbors are the dirt dishers, and the dirt dishers are the people who seemingly derive great pleasure out of discussing the mistakes of fellow human beings. The more mistakes there are the better time they have, and we are afraid of them, and one of the reasons we are afraid of them is that their criticisms are unjust. There was a foreman of the jury who was asked, "How do you arrive at your decisions?" And he said, "I don't pay no attention to nothing them attorneys say, or anything the witnesses say, I just look at the prisoner and I say to myself "If that fellow hadn't done something he wouldn't be here," and I fetch them all in guilty." A lot of people arrive at their conclusions just about that way and we are afraid of them.

"Tell me which one of the ten commandments is the most important. All of them are important and why is it that we pay so much attention to the others but so little to the ninth commandment. There may be some here who haven't seen the motion picture, so the ninth commandment is "Thou Shalt Not Bear False Witness Against Thy Neighbor." Not like the little girl in Sunday School who read "Go Ye Into All the World And Spread The Gossip To Every Creature." That is not the way it goes. Two Irishmen attended the funeral of a friend and before going they lubricated themselves with the oil of joy so that when they arrived at the place they were in a state of considerable incandescence and in one corner of the room stood the casket all covered with flowers and next to it was a grand piano covered with flowers and by mistake they knelt at the piano and one said to the other "He was a fine lad, he had a lovely disposition." And his friend answered "He had that" and looking at the keyboard "and a lovely

(Continued on page 40)



Tools used in this operation, Vascoloy-Ramet, Grade A for Cast iron, style 6, Tool size ¾" x ¾" x 4". Tip size ¼" x ⅝" x ⅝" standard grind.

Machining Motor Mounting—Material—Cast Iron—Operations ¼" Roughing cut, 1-32" finishing cut, facing 17⅛" to 13" intermittent cut—Comparative results with Vascoloy-Ramet Tools, Grade A and High Speed Tools.

Cast iron and cast iron alloys, semi-steel, brass, bronze, aluminum and aluminum alloys, nonferrous metals and materials, all steels from the softest to the hardest and toughest alloys—whatever the material there's a Vascoloy-Ramet grade which precisely fits the work in hand.

Produced in 17 standard grades, of different tantalum-carbide content, strength and hardness, Vascoloy-Ramet alone covers the entire range of machinable materials with a grade for every use.

This is why Vascoloy-Ramet is setting new records daily for increased pieces per grind, for faster time from floor to floor, for lowered production costs.

This is the reason for its rapidly increasing acceptance as the preferred tool material, in great industrial plants and in small shops, as well, throughout the country.

The new Vascoloy-Ramet catalog price list will be sent upon request.

Tools	Feed	Speed	Cutting Time	Pieces Per Grind
Vascoloy-Ramet Grade A	.030"	255 F.P.M.	2 Minutes	100 (complete order)
H. S. Steel	.030"	125 F.P.M.	6 to 8 Min.	6 to 12

VANADIUM-ALLOYS STEEL CO.
VASCOLOY-RAMET DIVISION, NORTH CHICAGO, ILL.

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. . . The TANTALUM CARBIDE TOOL MATERIAL . . .

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Newark........N. J.
Knoxville........Tenn.
Los Angeles........Calif.
San Francisco........Calif.

Technical School Offers

(Continued from Page 32)

cult to attain in the average manufacturing plant, where the urge to produce is so often the predominating factor. Industry in general does not offer the young man much, if any, opportunity for experiment and research; such work being usually delegated to a few select men. The technical school offers a certain opportunities for such work, although it must be admitted that in many cases too large a project is undertaken for the time allowed, so that no practical result is arrived at. However, it does give the future engineer an insight into the method and procedure in initiating and executing a research project.

There seems to be a feeling among some design and engineering executives, that much of what the student learns in the technical school is of little use to him in his future engineering work. It may be true, that while at school, the student does not have the time to work out many design or production problems; however, this varies more or less in different schools depending somewhat on the industries that are located in its vicinity. A technical training should give the young man entering technical work a fairly good knowledge of many of the technical aspects of engineering and should make him better qualified to appreciate the application of many theoretical principles in actual practice.

Moreover, his technical training should have familiarized him with the properties of the commonly used construction materials; the molding and casting of metals, so as to properly design a casting when one is needed; the heat-treatment and testing of metals so as to be able to take advantage of the more desirable physical properties obtainable by suitable heat-treatment. His work in the electricl laboratories should have given him some first hand information on electrical equipment; such as, motors, switches and magnetic control devices, which have become important items in recent production machine-tool designs. Instruction in the various types of gages for the control of accuracy and interchangeability is another item which the technical school can offer the student engineer. The cutting ability of various kinds of tools and the machinability of some of the commonly used metals is another subject on which the technical school has given industry considerable information. Various other kinds of information could be mentioned which the technical school can offer the student as preparation for work in the field of Tool Engineering.

Since the exact pathway to a certain goal in engineering cannot be determined definitely in advance, most engineering schools must offer a combination of courses which will permit the student to enter a variety of engineering activities.

Very often those students who are best prepared for work in the field of Tool Engineering go into some other branch of engineering; either, because they were not able to make the proper contacts or having made a fair start became discouraged by being kept too long on work below that which they were capable of doing. This does not imply that general factory work and various minor detail jobs should be eliminated, as the experience gained from doing many of the small jobs is often quite necessary in carrying through a big job. Furthermore, there is a feeling of con-

(Continued on page 40)

TRY-OUTS

(Continued from page 36)

set of teeth."

"Now the third fear that we all have is the fear of loss. We are afraid of losing this world's goods. William Allen White says his idea of hell is where every man owns a little bit of property and is always on the point of losing it. That is not a bad definition. There was a man in a restaurant and a chap came over to him and said, "Don't look now, but there is a fellow just going out with your overcoat." One of our leading economists, Mr. Groucho Marx, says that we seem to have worked ourselves from nothing up to a state of extreme poverty. And Ed Wynn, the prominent sociologist says "I do not believe that the world is going to the dogs. I know for certain that it was offered to the dogs and they refused it." So it is necessary to make a lot of adjustments in business. A tall chap said he didn't like to ride in the pullman cars because the berths were too short for him. He said "When I double up and face the aisle my knees stick out, and when I face the window they don't.

"We have to make adjustments. There was a merchant, who was a fugitive from a chain store, met a friend of his on the street. This chap had gone into bankruptcy. The merchant said, "I am going to make you a preferred customer. You are going to know now that you are not going to get anything and the rest won't know it for two weeks."

Quoted from the address of Chas. M. Newcomb

▼ ▼ ▼

Technical School Offers

(Continued from page 38)

fidence one can get only by actually working in a competitive shop atmosphere, which is lacking in the school shop or laboratory. Here one begins to appreciate the value of time and cost in getting things done.

Industry's Recognition

Industry is continually progressing and new technological processes are being developed. The work of the engineer today, whether his main interest is in Tool Engineering or in any other branch of engineering, is being more and more recognized as an important factor in our industrial and social life. As his responsibilities increase, the more he must know of economics, management and human relations in addition to the technical knowledge relating to his work.

TOLEDO—PROBABLE NEXT A.S.T.E. CHAPTER

Toledo, Ohio, will probably be the next industrial center to establish a Chapter of the American Society of Tool Engineers. Through the efforts of Mr. O. W. Winter, Chairman of the Detroit Chapter of the Society, and now employed and residing in Toledo, much interest and activity have been manifested in the establishment of a branch in that city.

On February 17th the initial meeting of the prospective Toledo Chapter was held. Nearly one hundred interested engineers of the Toledo area were present and about one-half of these men expressed their willingness to immediately become members of the American Society of Tool Engineers and form a Toledo Chapter.

Twenty-five paid and acceptable memberships are the minimum required to establish a branch and entitle a group to a branch charter and more than this minimum have already applied for membership in the Toledo Chapter. The pleasant duty of one of the next National Officers will probably be to charter the Toledo branch. Mr. Winter is also to be congratulated for his excellent work in promoting this Chapter which will be the ninth branch of the Society—unless the Buffalo Chapter now organizing is chartered prior to Toledo.

Increase Production

(Continued from page 14)

the register point against which the part is clamped; had to be made in the form of a micrometer adjustable stop. By using this method of adjustment, it was possible to make the upper cutter on the offset head fixed. All compensation for cutter wear being obtained by this micrometer adjustment. In this fixture, an auxiliary locator registers in the countershaft hole and two locators wheel housing contact flange. The part is clamped upward against the adjustable stop by means of a large hardened and ground plate that also serves as a loading platform. This plate is raised by means of a large hardened and ground course thread register in the dowel holes in the fly-screw, the screw being non-rotative. The nut is mounted between two machined surfaces and is equipped with a long heavy handle. The hardened clamp plate is carried between two slides. The clamp screw is mounted in two hardened and ground bushings. Two approximate stops are provided in each fixture so that in loading, the operator merely pushes the part against these stops before clamping into position. All locating pins and pilots are bullet-nosed so that no time is lost in finding the correct locating points. All wearing parts, such as locating dowels and pilots are mounted in liner bushings and are retained in place by nuts. This method is used for easy and quick replacement.

The advantages of this type of equipment over the previous method, increase the production from approximately 30 pieces per hour to 175-180 pieces per hour; increased the accuracy obtained by a wide margin; reduced the fatigue to the operator; and decreased the handling of the part.

Mathematics Versus Common Sense

(Continued from page 15)

performance or no pay. Six months were spent in re-building and bracing it but at the end of this time it was still a miserable failure.

We need both mathematics and common sense in the construction of metal working machinery to fill up to date requirements. We need mostly common sense in selecting modern machinery for modern work instead of trying to get along with machines built for an era that has passed. We can no more keep abreast of the times with antiquated production equipment than we could win a modern race with an outmoded car.

A great deal of mathematics and common sense can also be applied to the business end of the machine, in other words, the lowly cutter. Perhaps no other piece of equipment is subjected to as much abuse. Speeds, feeds, material, chips, lubrication, fixture and machine, any one or all of these may cause trouble, yes, even the cutter itself may be wrong. At any rate it gets the blame, no matter what the trouble may be. It is therefore just as sensible to have a layman design a cutter as it would be to have him fill out a doctor's prescription or a legal document. The experts will make mistakes, but these mistakes will be fewer and less glaring.

A good cutter man knows production methods, gearing, material and mathematics. He knows machinery and fixtures for he must design his own machines and fixtures for producing cutters. He therefore can be of untold value to the production executive.

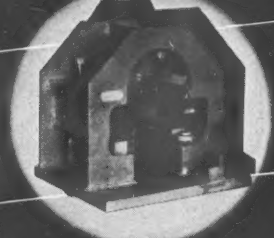
Let us apply mathematics liberally in our designs but let us temper them with a factor of "common sense" and our production equipment will become well suited for modern production.

When it's

TOOL-UP TIME

....IT'S A

SWEET TIME TO PICK WELDING



Consider the boring and back-facing fixture shown here. It is built of steel plate and bar stock by "*Shield-Arc*" welding. The overall saving, as compared to the old cast construction is $17.50. Exclusive of machining, which is about the same for both processes, the welded design costs half as much as the cast! Moreover, weight was cut 35 lbs. and the time for production, 3.5 hrs.

Are you realizing the savings of "*Shield-Arc*" welding in the building of jigs and fixtures? Get the booklet describing this profitable tooling-up process.

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REG. U.S. BRAND PAT. OFF.
ABRASIVE PRODUCTS

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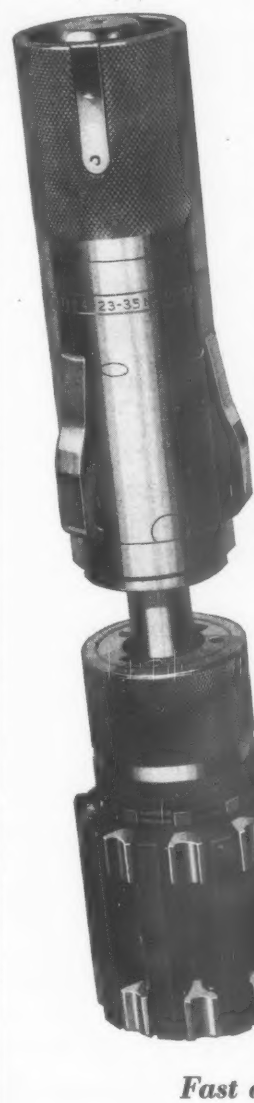

You get all 3 with the Carborundum Brand-Hutto Automatic Cylinder Hone

THE model "KKLF" hone has been developed for accurate, precise, high lustre finish honing of cylinder bores on a high production basis. Simplicity of construction with a minimum of wearing parts insures that it will stand up and deliver under the most severe working condition.

This hone is equipped with the patented full-floating, opposed cones which provide for automatic and positive expansion of the abrasive sticks. The resulting uniform pressure assures faster stock removal, greater accuracy, better finish and longer abrasive life.

A gang honing machine with eight honing heads of this type has an average output of 100 8-cylinder V-blocks an hour. Twenty-five complete strokes per block remove 0.002 in. of stock within limits of 0.0002 in. A high lustre finish is produced with a 400 grit Carborundum Brand Honing Stick.

Investigate the possibilities of automatic honing in your production schedule. Carborundum engineering facilities and experience in the manufacture of honing machines, heads and abrasives are at your disposal.

Fast and accurate

THE CARBORUNDUM COMPANY

REG. U. S. PAT. OFF.

Hutto Machine Division... Detroit, Mich.

(Carborundum is a registered trade-mark of The Carborundum Company)

Psychology in Industry

(Continued from page 17)

who keeps himself in good physical condition, is alert to the changing problems of society, and attempts to maintain himself in a plastic state. Why then should men past the age of forty-five be indiscriminately excluded from our industrial ranks?

The performance of men cannot be standardized. The problem of individual differences is the most difficult one confronting the industrial engineer today. Although it is a simple matter for him to standardize his machines and the more purely mechanical elements; when it comes to dealing with the human element in a mechanical fashion, he faces a much more difficult task. Man is not a machine and he cannot be reduced to a mathematical formula. The dictum that "all men are created free and equal" is an idealization, not a fact. (To be continued)

Returns to Old Associates

A.S.T.Eer, C. F. Staples has become associated with the Giern & Anholtt Tool Company, builders of boring equipment. Mr. Staples was with the original company as an executive for several years after the World War. He brings to the company a varied experience.

Production Perspectives

(Continued from page 19)

Co. in Waterbury (42 State Street) **to make bolts, screws, etc.** . . . **Risdon Mfg. Co., Naugatuck,** has **purchased** the **Consolidated Safety Pin Co., Bloomfield, N. J.,** and is **moving its equipment to Risdon plants in Naugatuck and Waterbury.** . . .

Frederick C. Billings, president of Billings & Spencer Co., Hartford, drop forgings and machinists' tools, for many years, has been **named chairman of the board,** with **W. A. Purtell,** active in the management for several months and vice-president of the National Supply & Machine Manufacturers' Association, **becoming president. W. Roy Moore continues** as **vice-president and general manager. Howard E. Oberg** was **named a vice-president and M. Mischmann re-elected** as secretary-treasurer. . . . **Columbia Metal Frame Co. of New Jersey** has leased 20,000 feet of floor space in **Stamford** and is **moving its plant to** the Lock City. . . . **Atlantic Screw Works, Inc., Hartford,** wood screws, has **elected Roy W. Johnson, factory superintendent,** as vice-president. Mr. Johnson began his industrial career with Wickwire-Spencer Steel Wire Co. in 1924 and came to Atlantic in 1933. . . . **General Electric Co., Bridgeport, is shifting its washing machine division to new factory space recently acquired from Remington Arms Co.,** and upon completion of the transfer **will have one of the largest washing machine plants in the East.**

MIDDLE WEST

Among the products pouring out of the plant of the **Stoker-Unit Corporation, Milwaukee,** has been a **special milling machine for milling recesses in cylinder heads of refrigerators built by the Crosley Co.** The erection of a large one-story building has been announced by the **Chain Belt Co.** It will be located at the company's West Milwaukee works, and will house the machine shop. Chain Belt's **industrial expansion will be the biggest in years here.** Chain Belt seeks to provide more space at the Bruce St. plant for manufacture of chains. It is anticipated that by having the machine shop located closer to the assembly departments, manufacturing operations will be considerably facilitated. **While some new equipment may be installed in the building, the major portion will consist of equipment taken over from the older shop** of Bruce St.

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A Cost Cutter for Every Job

THERE is an O K Inserted-Blade Cutter for every job of slotting, milling, facing, boring or other type of metal cutting. Name the job—we'll supply the cutter. With it we'll supply a means of reducing your metal cutting costs, as against solid cutters.

In O K Milling Cutters the inserted blades, that do the cutting, are of high-speed steel specially heat treated for edge life; the body, which does no cutting, is of chrome nickel steel heat treated for strength. There is a distinct saving in the cost of cutting steel, and the ready adjustment possible for wear compensation works to cut down the total time cost.

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THE OK (TRADE MARK) SYSTEM

OF INSERTED-BLADE METAL CUTTING TOOLS

WITHOUT HAMMERING blades can be rigidly locked or quickly unlocked for adjusting

This Mechanical Principle of the

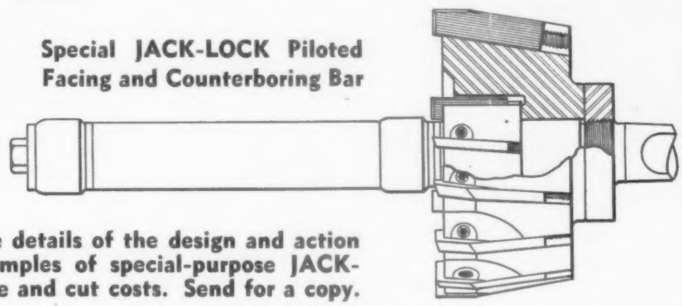
McCrosky JACK-LOCK

Pat. Nos. 1,681,675 and 1,951,101

simplifies the design of special-purpose serrated-blade tools

The JACK-LOCK Wedge and its lifting screw are a self-contained unit occupying small space in the tool body. Tightening the screw lifts the wedge LIKE A JACK, forcing it over against the blade with a powerful compound wedging action.

Special JACK-LOCK Piloted Facing and Counterboring Bar



McCrosky Bulletin No. 15-F gives complete details of the design and action of the JACK-LOCK, and shows many examples of special-purpose JACK-LOCK tools that have improved performance and cut costs. Send for a copy.

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THIS MONTH'S COVER

From present indications the 1937 motor car will have an increasing number of applications of the needle bearing. Different makes will have needle bearing assemblies at such points as front spindles, transmission cases, clutch fingers, idler gears, pump gears, steering worm sectors, and transmission countergears.

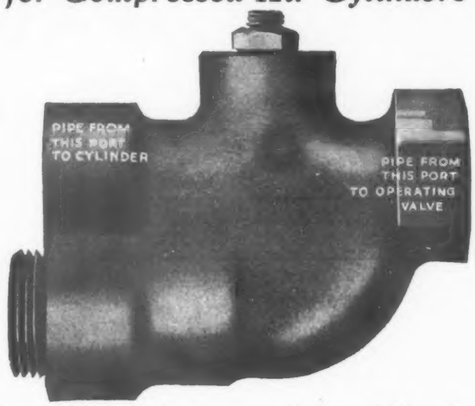
The illustration on This Month's Cover shows a new development in an assembling machine, the first of its kind, having two hoppers feeding twenty-two needle rollers into each end of a countergear and in the same cycle inserting a steel tube filler and a dummy shaft.

The operator of this machine places a countergear into a slide fixture, actuates a foot lever which starts the machine and automatically performs the following operations: steel tube filler and dummy shaft are inserted into the gear, the slide fixture advances to the needle roller station where a charge of twenty-two needle rollers is assembled at both ends of the gear. The slide then returns to the starting position ready for another cycle.

The time of the cycle of this machine is—ten gears, ten fillers, ten dummy shafts and four hundred and forty needle rollers per minute. The hoppers handle over two hundred thousand needle rollers in eight hours which indicates the efficiency of this machine.

The machine was manufactured for a large automotive manufacturer by the Rehnberg & Jacobson Manufacturing Company of Rockford, Illinois. The above information and photograph has been furnished through the courtesy of the Sterling-French Machinery Company, Detroit, Michigan.

T-J SPEED CONTROL VALVE
for Compressed Air Cylinders



Control the speed of your cylinders. Make them function as fast or as slow as you wish, without affecting the pressure of course. Pipe one of these in the line from the operating valve to the cylinder, or if both the forward and reverse strokes are to be controlled, pipe one in the line to both ends of the cylinder.

These valves are available in 1/4″, 3/8″, 1/2″, 3/4″, and 1″ I.P.S.

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Detroit Representative, HABERKORN & WOOD

"MODERN" Manufacturing Demands
CORRECT SPEEDS for END MILLS

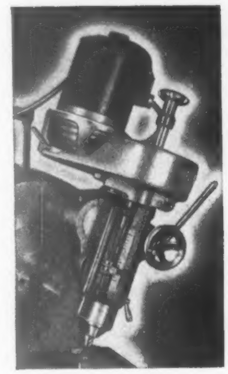
Tool	1/16″-4000	1/4″-1100	1/2″-500	Approx.
Steel	1/8″-2100	3/8″- 700	1″-250	Speeds

The 'EKLIND'

Has These Speeds And

MILLS
DRILLS
and
BORES

AT ANY ANGLE
IN ANY PLANE



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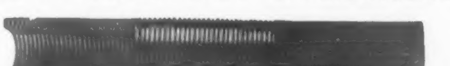

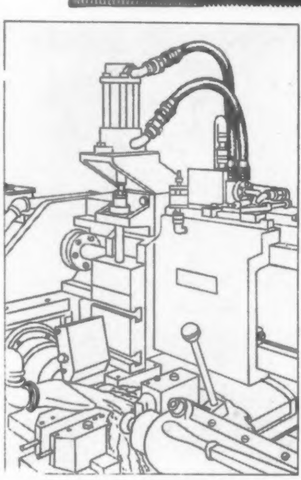

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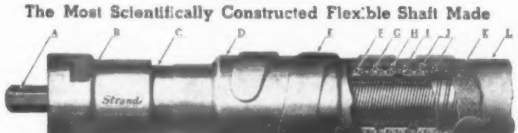

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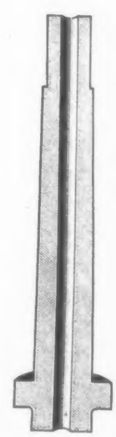

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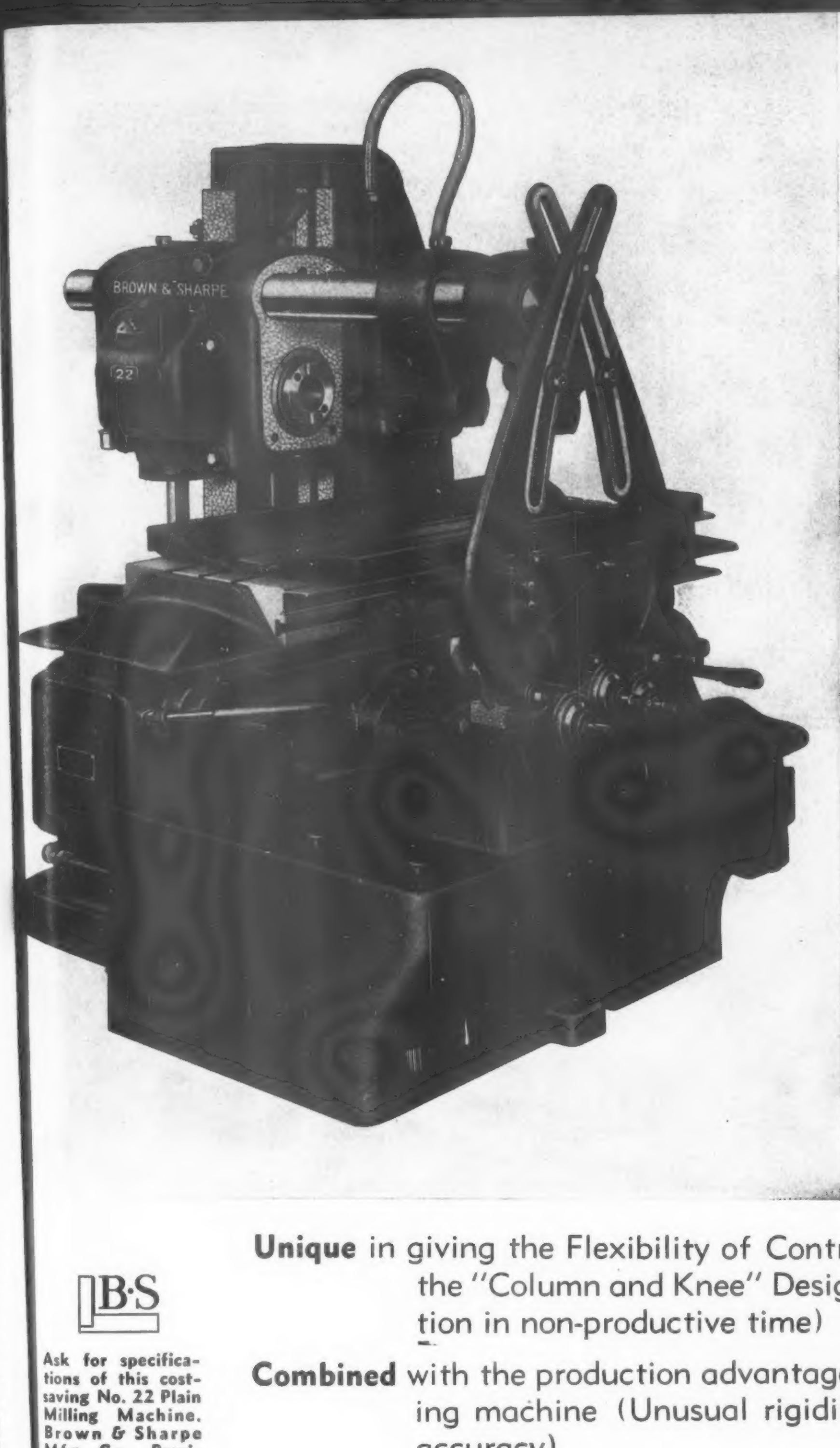
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